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Rubber Cultivation and Livelihood - A Stakeholder Analysis in Xishuangbanna, Southwest China

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Abbreviations

ADB	Asian Development Bank
AKIS	Agricultural Knowledge and Information Systems
CAU	China Agricultural University
DFID	Department for International Development
FAO	Food and Agricultural Organization
FZID	Center for Research on Innovation and Services
GIZ	Gesellschaft für Internationale Zusammenarbeit
HRS	Household Responsibility System
HU	Humboldt-Universität zu Berlin
ODI	Overseas Development Institute
NRWNNR	Naban River Watershed National Natural Reserve
NPA	Natural Protected Areas
NRM	Natural Resource Management
NTFPs	Non Timber Forest Products
PBL	Problem-based learning
PRA	Participatory Rural Appraisal
RAAKS	Rapid Appraisal of Agricultural Knowledge Systems
RMB	RenMinBi
RRA	Rapid Rural Appraisal
R&D	Research and Development
SA	Stakeholder Analysis
SALB	South American Leaf Blight
SMS	Short Message Service
TOT	Transfer of Technology
UNEP	United Nations Environment Program
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
XTBG	Xishuangbanna Tropical Botanic Garden
YTPRI	Yunnan Tropical Plant Research Institute

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1 Introduction

1.1 Problem Situation

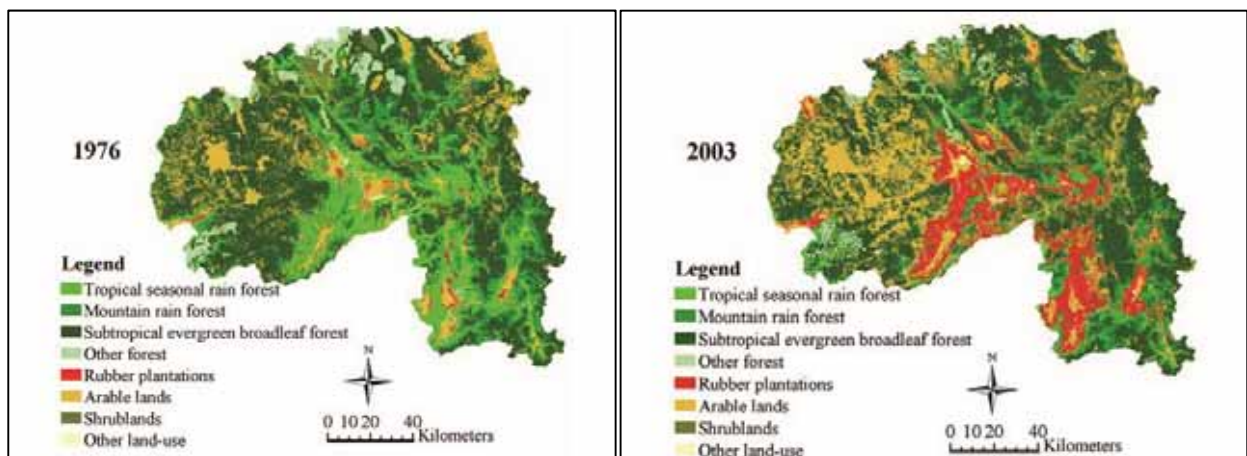
Over the last decades the demand for natural rubber has steadily increased. In addition to Thailand and Malaysia, the main rubber suppliers are Vietnam, Laos, Cambodia and South China. The rising demand and the profitability of rubber cultivation have led to a change in the land use systems in the producing countries. Formerly diverse and natural landscapes have been converted to monoculture production systems.

The land use system in Xishuangbanna has undergone a rapid transformation. Since the introduction of natural rubber in the 1950s, the region has experienced large socio-economic and ecological changes. Until the 1980s, rubber cultivation was strictly in the hands of the socialist state farms. Nowadays, smallholder farmers hold a big share of the rubber production in the NRWNNR, resulting in a rapid, regional, economic growth over the last decade.

Today, the NRWNNR is characterized by a social and economic heterogeneity. The wealth gap is continuously growing. Disparities concerning the income situation in the upland and lowland regions in the NRWNNR appear to be very high. While the lowland villages have already been transformed into market oriented cash economies, most of the communities above the rubber production line still live in subsistence. With the abandonment of traditional crops the local farmers gave up their self-sufficiency (WEHNER 2011). The dependency on rubber as an income source is steadily increasing.

The overall economic growth is accompanied by an ecological degradation. In former times the region within and around the NRWNNR was a biodiversity hotspot. The increasing loss of natural forests in recent years leads to a steadily decreasing level of biodiversity. From 1976 to 2003, the forest cover in Xishuangbanna has decreased by 14,000 ha per year, which accounts for 50% of the total forest area, while the primary forest was reduced to 3.6% (Figure 1).

Figure 1: The expansion of rubber forest in Xishuangbanna from 1976-2003



Source: LI et al. 2007: p. 1739

One of the most important ecological impacts of rubber cultivation in the research area is the decreasing water quantity, as well as quality. Rubber monocultures change the hydrological

systems within the target region, e.g. increased surface run-off, lower infiltration rates and an overall decline in water quantity.

Besides reducing hydrological resources, the water quality in the research area is threatened by the application of fertilizers and pesticides, as well as an increased accumulation of sediments in the river systems, due to the transformation of mountainous areas into rubber forests (AHLHEIM et al. 2012).

According to SURUMER (2012a) the main ecological impacts of rubber cultivation in the research area are:

- Changes in sustaining ecosystem services and functions, affecting both local water balances and water quantities as well as the quality through the increased use of agrochemicals. Additionally, there are consequences regarding carbon dynamics, affecting biological processes, soil fertility and hydrological functions on a broad level;
- The reduction of agro- and natural biodiversity of traditional land use systems, accompanied by the interference on pollinator services for relevant food crops;
- The higher vulnerability to climatic changes, pests, diseases and economic risks and the increasing inability of a rapid adaptation.

Besides ecological and economic consequences, the expansion of rubber cultivation has a high impact on social lifestyles of farmer households (TANG et al. 2010) and the knowledge dissemination in the target region.

In respect to the environmental conditions, TANG (2013) found that many changes have occurred over the last decade. Previously, limited contact with outsiders due to geographic conditions was a limiting factor in knowledge dissemination. At that time many villagers had never even been to Jinghong or Menghai. Poor transportation, a lack of electricity, and poor television reception caused most information to spread internally within the villages. From her discussions with village heads, it has been revealed that since roads, electricity and satellite dishes have been implemented, distance as a key indicator of knowledge dissemination is less of an issue.

In order to address existing problems in the research area, the present study aims to generate a general, better understanding of the stakeholders and their perception of the problem situation.

Furthermore the study wants to determine existing and missing information about formal communication networks, stakeholders' interests, land use practices and alternatives to rubber.

1.2 Objectives

This study is part of the sub-project 8 of SURUMER - Knowledge Transfer and Interaction Management: Facilitation of Trans-disciplinary Process and Communication Measures. The main objective of the sub-project is to develop practice-tested methodology that creates a knowledge and information flow between the several stakeholders of the project, e.g. regional decision makers, farmers, researchers, extension staff, etc. Sub project 8 assists in "... the multi- inter- and transdisciplinary discourse in all project phases from mutual planning to partici-

patory monitoring and evaluation of the concept" (SURUMER 2012b). To guarantee an integration of every stakeholder on all levels a dialogue-oriented research process is required.

A stakeholder analysis will be conducted to properly identify the stakeholders in rubber cultivation from the NRWNNR and help understand all of the factors that surround rubber production in these villagers' lives. The purpose of this research is to provide information that could be used in the future for further development of rubber research in the region. This knowledge about the stakeholders' interests, communications, and problems can be essential for the SURUMER's future communication and implementation phases. It provides the basis to identify potential conflict of goals and opportunities for encouraging stakeholder active participation. Therefore, it can contribute to understanding and implementing a more sustainable rubber cultivation system in the region.

The research will create a basic picture with a stakeholder analysis by focusing on communication networks, stakeholder problems, and interests of the stakeholder. A review of relevant literature shows that the available information on these topics is limited.

- **Methodology:** The research methodology was introduced and developed with an application to future stakeholder analyses and replication of this model for improved research quality. It is meant to increase interdisciplinary teamwork and to achieve the most feasible results while still remaining explicative.
- **Stakeholder Analysis:** The main objective of this chapter is to identify the most influential people regarding rubber farming in the NRWNNR Villages by analyzing power and interests in the decision-making of cultivation methods; Elucidating the diversity of actors who take part in rubber cultivation and whose perceptions and knowledge have an effect on the cultivation patterns of rubber in the NRWNNR villages; Understanding of the multiple and sometimes contradictory interests of the people involved and their agenda for the upcoming future.
- **Land Use:** Identifying Chinese Land Use Policies on a national and regional level and their consequences on farming systems within the NRWNNR is one objective of this section. An overview of the historical and current land use practices with a focus on cultivation and expansion of rubber in Xishuangbanna. At the NRWNNR village level, the focus is set on identifying socio-economic factors and regulations influencing current land use practices. The main objective is to have a better understanding of farmers' perceptions on rubber cultivation through a holistic view of land use and land use changes. Additionally, land tenure systems and land ownerships on the village level will be clarified to facilitate identifying responsible stakeholders concerning land activities. These may later serve as contact persons.
- **Alternatives:** Economic activities of farmers aside from rubber were identified. Alternatives present a possible opportunity for farmers to reduce their dependence on a single source of income based on rubber. They also provide opportunities to learn about how the stakeholders obtain information and support from the agricultural knowledge system. This information is vital in the implementation of future rubber and non-rubber cultivation systems.
- **Stakeholders' Problems:** The present research creates insight into the stakeholders' problems and their perception towards existing economical, ecological, as well as social impacts when expanding rubber cultivation. The results of the section will con-

tribute to the identification of the main ecological and socio-economic deficiencies in the target region and therefore help further studies in their efforts to develop a stakeholder-oriented action plan.

- **Interests:** Identification of stakeholders' interests and ambitions will deepen the understanding of stakeholders' needs and their motivation, both for growing rubber as well as improving rubber cultivation. This is vital to properly understand the current situation and possible future trends for the chosen villages and their inhabitants.
- **Communication:** In this section the dissemination of knowledge and communication networks will be described in detail. The means by which farmers obtain and share information about rubber cultivation are identified. This includes the respective sources of information.

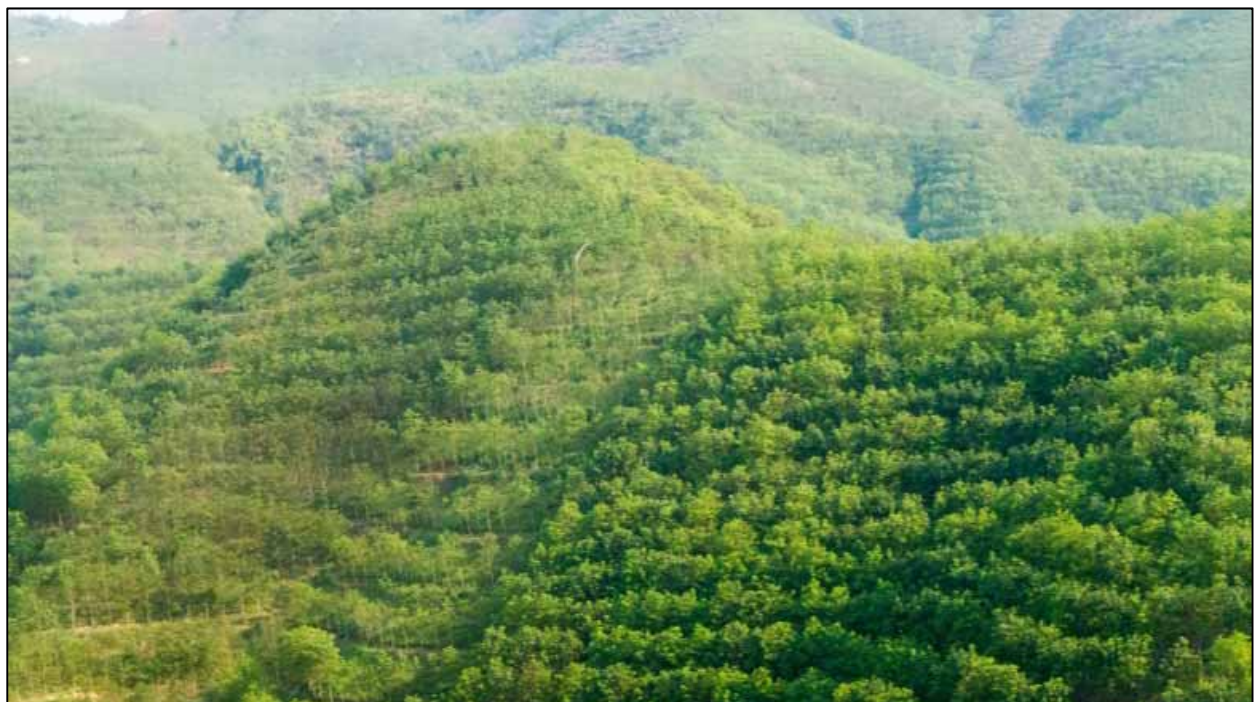
2 Theoretical Framework

The purpose of this chapter is to provide a general overview about the theory in which the study project has been focused. In the first part, the basic definitions of rubber, its genesis and discoverers, cultivation, sustainability and sustainable development, and how the concepts are interrelated within the agricultural process are presented. The second part will address the issue of the stakeholder analysis' main characteristics from its typology, origins, and principles as well as the problems and interests involved in the analysis. Likewise, the view of different authors is explained as are the methodologies developed in order to seek the adequate selection and allocation of stakeholders. Finally, the third part will describe the communication network definitions and component and the types of networks in rural development. Additionally, the focus will include the attributes and characteristics of the local networks.

2.1 Sustainable Rubber Cultivation

The Rubber Tree (*Hevea brasiliensis*) is a native tropical species of South America. The first taxonomic identification and description was done by the French botanist Jean Baptiste FUSÉE AUBLET in 1775, whose contribution led to make rubber be known in Europe. It had already been identified in previous years in what was called the “Rubber boom” in South America. (BARLOW 1997).

Picture 1: Rubber trees in Xishuangbanna



Rubber cultivation requires deep soils, and most of the trees are grown in relatively high temperatures with continuous moisture throughout the year. However, temperatures of 18° C

would not affect the vegetative growth but reduces latex yield. During the vegetative development stage, (first 6 years), fertilizers are needed when the biomass is building up (VERHEYE 1997).

Rubber is cultivated around the world where climatic conditions are feasible for it. However, more and more rubber is becoming adapted to temperate weather due to research and genetic improvement of cultivation techniques. The goal is to expand its production to different weather and altitude conditions. It is also called the “Para Rubber” of international commerce (PRABHAKARAN 2010). Nowadays, rubber is cultivated as far north as 25° North (Yunnan Highlands, China) and as far south as 21° South in Brazil (VERHEYE 1997).

Concepts of Sustainability

There are several definitions of sustainability, used in various disciplines: economics, ecology, sociology, engineering and physics, among others. According to the ecological view, sustainability is “*the degree to which a process is able to be maintained while avoiding the long term depletion of the natural resources*” (GLAVIC and LUKMAN 2007)

In the context of environment and development, the term sustainability was formally used for the first time by the BRUNDTLAND Commission in the United Nations in 1987. Under this premise, the following meaning was used: “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*” (ZACCAI 2012).

In order to understand sustainability in its broader sense, some authors have analyzed the different contexts in which the term has been used. In LELE’s (1991) review of renewable resources like forests or fisheries, he delimits sustainability as “*the existence of the ecological conditions to support human life at a specified level of well-being through future generations*”.

Sustainable cultivation

Sustainable cultivation or sustainable agriculture, integrates three main goals: environmental health, economic profitability, and social and economic equity. In this concept, the determinant aspect of sustainability is the ability to adapt to future potential changes (VERHEYE 1997).

Alternatives to rubber cultivation

For a thorough exploration of alternatives in the context of this research project, the definition of alternative as “... *available as another possibility or choice*” (OXFORD DICTIONARY), again proves too simplistic when applied to the possible alternatives and choices that can be considered in the tropical climate. It is necessary to highlight the importance of an alternative being defined as a possibility or choice that ensures both ecological and economic viability as well as sustainability of stakeholders. To qualify, the alternative must be able to support a stakeholder’s livelihood should rubber cultivation no longer be a possible sustainable alternative.

For the purpose of this analysis, an alternative will be identified where both an economically and ecologically viable source of income for families can be used to replace or supplement

rubber cultivation. That is, the stakeholder's current living conditions and income would either be supplemented or improved by this alternative when compared to the income currently received through rubber cultivation and production.

Farmers in many rural regions of the world have experienced their quality of life improve under income diversification through alternatives. According to CARLETTO et al. (2007: p. 173) the importance of off farm income alternatives are "across the board" vital for rural inhabitants income to advance and stabilize.

CARLETTO et al. (2007) also found that off-farm income alternatives are the most important considerations in the role of providing supplementary or alternative incomes for rural families. In the context of this study, examples of such alternatives would include the renting of farmers land and additional income obtained from work that is not related to the rubber industry. Other studies have also determined that another important factor of sustainable income lies in diversifying farming activities.

The FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO 2000) found that agricultural diversification that targets niche markets such as honey or exotic plants, livestock, or agro-forestry were vital in farmers hedging against risks. Such niche markets can provide possible alternative income source solutions for farmers whose income from rubber production is not considered viable or sustainable. Consequently, the consideration of alternatives to rubber income seemed pertinent to this study and analysis of stakeholders.

Practically, the research must define factors that determine and define whether an alternative could be considered as a viable competitor or supplement to the income that is currently provided by rubber cultivation and production or not. There was no minimum monetary amount outlined to determine whether an alternative would qualify as an income alternative. Instead, the determining factor depends on the individual stakeholder's subjective assessment of this alternatives' profitability.

2.2 Stakeholder and Stakeholder Analysis

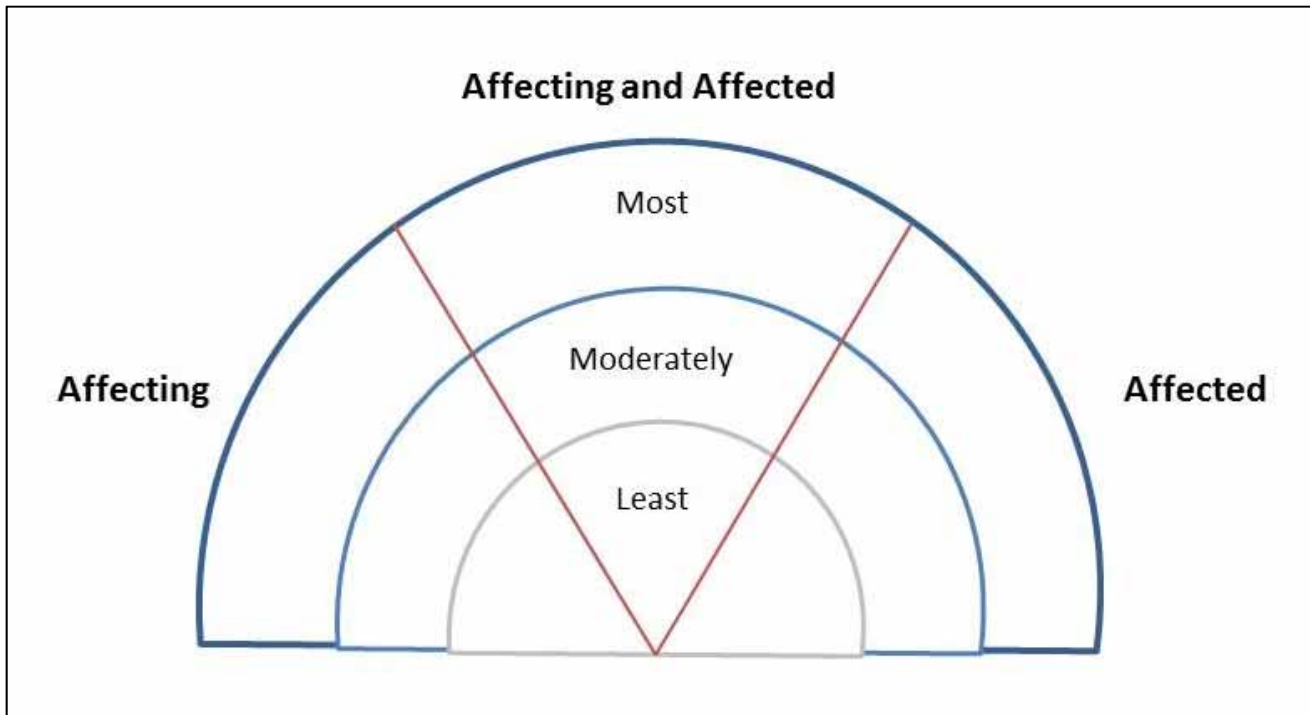
This chapter provides an insight about the main and basic concepts of stakeholders, origins, typology and the concepts developed by several authors under diverse disciplines and thought profiles.

2.2.1 Definition and meaning of Stakeholder

A first definition of stakeholder comprises the identification of individuals, groups or organizations that can affect or are (positively or negatively) affected by a decision or action (Figure°2) (GRIMBLE 1998; BRYSON et al. 2011).

Policy planning and development programs are moving towards methods with a social actor perspective to elucidate power relations and conflicting interests. Any public problem can affect numerous and diverse people, groups, organizations, and sectors. The solution does not depend entirely on one single actor, but rather on those who have partial power and therefore responsibility to act (BRYSON et al. 2011).

Figure 2: Classification of stakeholders according to the degree of affection by decision



Source: REED et al. 2009: p.1938

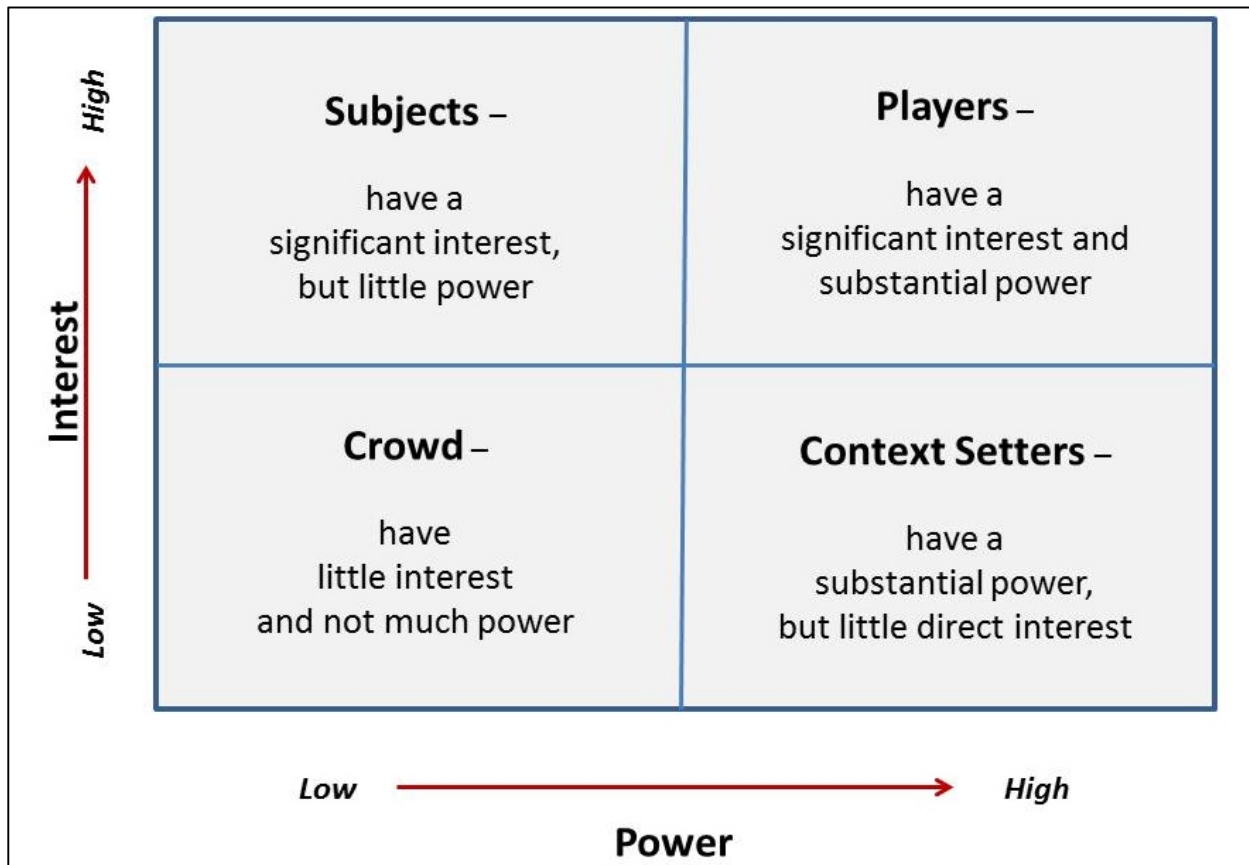
Other important factors influencing stakeholder's position towards a project are power and interest. With this approach four clusters of stakeholders can be identified:

- (i) Players: Those who have both an interest and significant power;
- (ii) Subjects: Those who have interest but little power;
- (iii) Context setters: Those who have power but little interest and;
- (iv) Crowd: Those who have little interest and power.

The identification of these clusters shows key informants and may indicate the direction of future actions in increasing competence and awareness to the projects. For instance, in the case of 'Subjects' who have interest but limited power, a desired action is enhancing their capacity to get involved. This can increase their influence on decision making. For the 'Context setters', a mechanism to increase their concern are needed. Major efforts are needed to boost the participation of the 'Crowd' since they are neither interested, nor powerful in the problem-solving. In spite of the accuracy of this tool to classify stakeholders, interest and power are variables in constant change. Stakeholders may lose interest or gradually gain power if alliances are formed (REED et al.2009). The 'Power versus Interest Grids' (Figure 3) is a visualization of these categories.

Once the classification on stakeholders' interest and power is done, the analysis should follow to reveal sources of power and the usage of such power related to their interests and future plans (BRYSON et al. 2011). An illustration of this analysis is given in Figure 4. In the bottom of the diagram sources of power are pointed out whereas in the top arrows indicate the interest and concerns in which that power is intended to be used.

Figure 3: Power versus Interest Grids



Source: BRYSON et al. 2011: p. 5

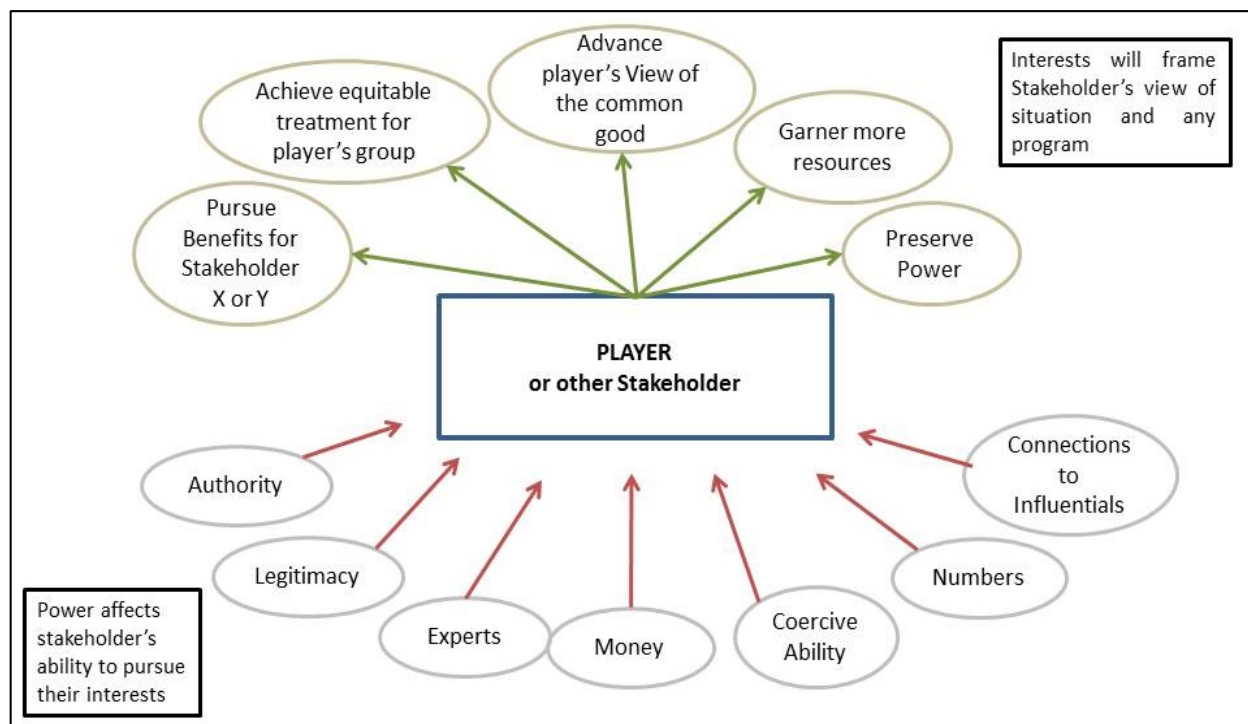
Combining analytically all the previous aspects, four clusters can be identified for pragmatic classification of stakeholders in a rural development program: (1) people who have decision authority over the program, including policy makers and funders; (2) people who have direct responsibility in implementing the program; (3) people who are intended beneficiaries of the program and their families or communities; (4) people disadvantaged by the program. Government as an abstract institution is not considered as a stakeholder, but its representatives might be since they can voice the official position from different levels of interaction with other stakeholders (BRYSON et al. 2011).

Although these factors facilitate the categorization of stakeholders, it is not a straightforward decision. Rather, the iterative process usually becomes more complex as the analysis is further developed (REED et al. 2009). For instance, when stakeholders are identified in a top-down manner, there is a risk of leaving out some actors whose opinions might be relevant for the program. Nevertheless, this issue can be corrected by using participatory research methods that promote bottom-up re-categorization (REED et al. 2009). By asking key informants about whom they perceive as being relevant the stakeholders and their relationships can help identify categories or roles (GRIMBLE 1998).

Another remark about the identification of stakeholders is that each group often has diverse interests which, although rational, might be opposing (GRIMBLE et al. 1995). Thus, even though SA attempts to consider the information about interests and concerns of key stake-

holders, it does not necessarily imply that stakeholders would be entirely satisfied with the intended program or policy (BRYSON et al. 2011).

Figure 4: Stakeholder influence



Source: REED et al. 2009: p. 1936

A final feature of this method is the insight on the stakeholder's perception about the decision-making frame; that is, the system boundaries where the stakeholders perceive their action becoming increasingly limited until decisions seemed to be as out of their individual control (GRIMBLE 1998).

2.2.2 Definition of Stakeholder Analysis

Poor outcomes or failures in development programs associated with the lack of support and even opposition from the intended beneficiaries have fostered the use of the Stakeholder Analysis in fields of political science and policy design (RASTOGI et al. 2010). Conventional methodologies such as cost-benefit analysis measure gains and losses that do not reflect the distribution of these costs between different stakeholders and do not recognize that the problems are observed in different ways by the actors involved (GRIMBLE et al. 1995). In contrast, SA aims to provide a broader view of the private costs and benefits perceived by the stakeholders in order to understand their process of decision-making.

Giving attention to people's perceptions, the method emphasizes processes of social construction (CHEVALIER and BUCKLES 1999) addressing questions about representation, legitimacy, participation, power, and knowledge. As FRIEDMAN and MILES (2002: p. 4) point out:

"The theory behind the Stakeholder Analysis accepts that in the context of social interaction, actions are taken and ideas formed in relation to a perceived (socially constructed) reality, thereby changing the social reality."

There is plenty of empirical evidence about the positive consequences of considering the interests and information held by key stakeholders in development programs (BRYSON et al. 2011; RASTOGI et al. 2010; REED et al. 2009). Absence of SA could result in excluding important groups and thus jeopardize the viability of a program over a long period of time (BRYSON et al. 2011). Furthermore, there is also the risk that powerful and well-connected stakeholders have a greater influence in decisions that benefit them but harm marginalized people. Including marginal stakeholder's opinions in a participatory planning of rural development policies and natural resources management has an intrinsic value as means to empower them in influencing decision-making processes. Indeed, it is often claimed that SA can contribute, or at least facilitate, learning among stakeholders by sharing points of view and knowledge (REED et al. 2009).

Stakeholder Analysis in Natural Resource Management (NRM)

SA can assess the different stakeholders' current usage of natural resources and the perceived value of them, reveal the competition or conflict over natural resources and identify the social networks in which the stakeholders embedded and the distribution of social impacts (CHEVALIER and BUCKLES 1999). Since the 1990s, the utilization of SA in this arena has increasingly gained prominence as it seeks to understand stakeholders' agendas and diagnose the threats for future welfare at local or wider levels in society (GRIMBLE 1998). SA is often used as a methodology for ex ante appraisal of projects and policies, ex post evaluation of projects and policies, general research on natural resource management, and also as analytical support to an on-going process of conflict resolution and cooperative management of a resource (GRIMBLE et al. 1995). Key objectives of SA in NRM are:

- To improve the effectiveness of policies and projects on the ground by explicitly considering stakeholder views.
- To better address the distributional social impacts (Grimble et al. 1995).

This rationale can be accurately understood with the following statement: "Knowing who the key actors are, their knowledge, interests, positions, alliances, and importance related to the policy allows policy makers and managers to interact more effectively with key stakeholders and increase support for a given policy or program. By carrying out this analysis before implementing a policy or program, policy makers and managers can detect and act to prevent potential misunderstandings and/ or opposition to the implementation of the policy or program. A policy or program will more likely succeed if a stakeholder analysis, along with other key tools, is used to guide its implementation" (SCHMEER 1999: p. 3).

Stakeholder Analysis in the context of R&D projects

A vast amount of research about stakeholders has focused on theoretical discussions and debates about the concept of stakeholders and the nature of stakeholder theory. Although it is widely accepted that SA provides a baseline for the identification, classification, and categorization of stakeholders and the understanding of their behavior (AALTONEN 2011), there are multiple definitions of SA. One general definition given by GRIMBLE (1998: p. 1) delineates

SA as “... a methodology for gaining understanding of a system and for assessing the impact of changes to that system, by means of identifying the key stakeholders and assessing their respective interests”

SCHMEER (1999: p. 3) highlights the qualitative approach of the analysis: “Stakeholder analysis is a process of systematically gathering and analyzing qualitative information to determine whose interests should be taken into account when developing and/or implementing a policy or program.”

A wider definition proposed by REED et al. (2009: p. 1933) includes the consideration of non-human entities and future generations saying that “... Stakeholder Analysis is a process that: (i) Defines aspects of a social and natural phenomenon affected by decision or action. (ii) Identifies individuals, groups and organizations who are affected by or can affect those parts of the phenomenon (this may include non-human and no-living entities and future generations); (iii) Prioritizes these individuals and groups involvement in the decision-making process”.

For our study, Stakeholder Analysis is understood as an approach for understanding who are the key actors regarding rubber cultivation in villages and assessing their interests and influence in decision-making for cultivation methods.

2.2.3 Types of Stakeholder Analysis

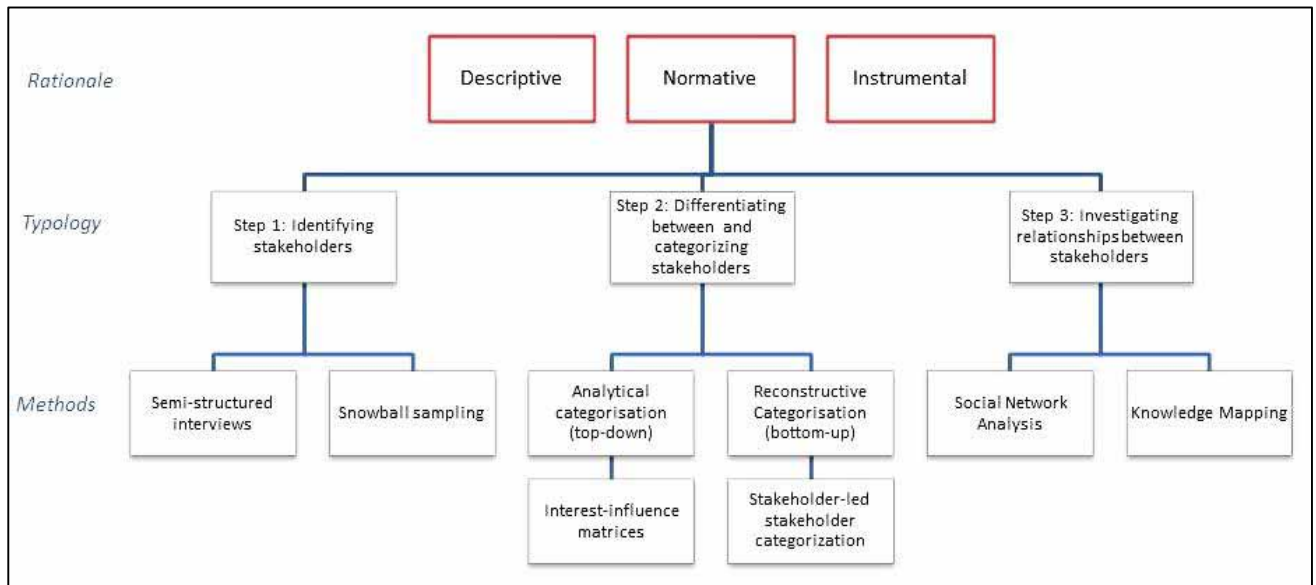
There are three kinds of SA: descriptive, instrumental and normative (REED et al. 2009). The descriptive approach provides a picture of the actors involved in a social environment (AALTONEN 2011). The instrumental approach is more pragmatic, attempting to understand the behavior of stakeholders to accomplish desired outcomes (REED et al. 2009).

The normative approach values the participation and consideration of stakeholders in decision-making as an empowerment process (REED et al. 2009). From this approach SA acknowledges the significance of stakeholder’s participation for public welfare. Consequently, it may lead to instrumental outcomes as well if stakeholders are truly involved and feel some level of ownership of the process. The rationale, typology, and research methods of the SA are visualized in Figure 5.

As observed in Figure 5, the main stages in the SA after clarifying objectives of the analysis, can be summarized as (i) Identification of stakeholders, (ii) Categorization of stakeholders according to their interests and agendas and (iii) Investigation of patterns of interaction and dependence between stakeholders assessing their power and its sources (GRIMBLE 1998; BRYSON et al. 2011; REED et al. 2009).

There are several methods to investigate the stakeholder relationships. However, for this study the main method employed was the Social Network Analysis, which will be analyzed in Chapter 9, whereas the research process and methods used in this study are described in further detail in the Methodology section in Chapter 3.

Figure 5: Schematic representation of SA development



Source: REED et al. 2009: p.1936

By involving the people's perceptions in different stages of programs for rural development through stakeholder analysis will result in more successful achievements and efficiency in decision-making (BRYSON et al. 2011). SA as a methodology also has its limits and weaknesses:

First, SA tends to treat stakeholders as distinct entities, while in reality some social groups are not necessarily exclusively defined (GRIMBLE 1998). Some stakeholder may have different roles in the analyzed problem of multiple stakeholder clusters (GRIMBLE et al. 1995). Membership to different stakeholder groups might complicate the analysis of competing interests (REED et al. 2009).

Second, identification and categorization of stakeholders as well as their power, influence, and legitimacy rest on subjective assessments. Since the recognition of the stakeholders is done according to researchers' interests, it certainly has some biases (intended or unintended) to approach key representatives and find out about their communication networks (PRELL et al. 2009).

A third limitation is related to ethical issues in which the information from less powerful groups is used by the powerful groups in a manipulative way (GRIMBLE et al. 1995). Indeed, this might not be a weakness of the methodology itself, but rather on how it is utilized.

Finally, SA also increases the complexity of research because of the analysis of diverse and conflicting perceptions (REED et al. 2009). Therefore, "... stakeholder analyses must be undertaken skillfully and thoughtfully, with a willingness to learn and revise along the way." (BRYSON et al. 2011: p. 7).

A necessary step in the planning and design of research and development programs is situational analysis. It provides a detailed review of *the interests, problems and alternatives* within the context of which stakeholders operate. Traditionally, the analysis is conducted at two levels:

- The development context provides an overview of how a community operates, in terms of resource base, social and institutional structures, and factors that change over time.
- Livelihoods analysis provides a more detailed examination of how members of the community obtain income, with consideration to their use of resources and time, and identification of the benefits generated. Rapid Appraisal techniques are well suited for conducting a situational analysis (FAO 2000).

As described by FARRINGTON et al. (1999), information can be collected in a participatory manner, in a style that is relevant to the both community's or individuals interests, and through a process that enables all voices in the community to be heard. In addition, they offer:

- flexibility
- receptiveness to new and unexpected ideas
- two way flow of communication
- process for empowering people in the community
- information validation during the collection process

2.2.4 Aspects to be analyzed

A common feature of the conceptualization of this methodology is the attention given to detect key stakeholders and their problems and interests as the central part of the analysis. Although categorizing stakeholders *"is always an interpretative process"* (AALTONEN 2011: p. 165) there are some parameters and tools which can be simplified as REED et al. (2009: p. 1934) phrase it: *"Who's in, and why?"*

Stakeholder Problems

By a simple definition a problem is *"a perceived gap between the existing and a desired state, or a deviation of a norm, standard, or status quo"* (BUSINESS DICTIONARY 2012). Such a simple definition may prove inadequate when assessing and determining problems from the research and data collected in the particular context of the current SA (Stakeholder Analysis). In this context, where the problems are able to be identified from highly diverse and complex factors and sources, a much more thorough and comprehensive definition and understanding of problems is required to make adequate analysis.

As problems always underlie the subjectivity of involved parties, difficulties often occur when attempts are made to achieve a common and agreed understanding between parties. Consequently, external parties are often employed as an unbiased aid, not only to foster the cooperation and understanding of the involved parties' subjective problems but also to facilitate the process of developing and agreeing on a favorable solution for all involved.

Nonetheless, it is important to consider that often problems of individual parties are not solvable and alternative solutions must be reached. This can also become problematic when factoring in the various differences in the objectives of stakeholders within the NRWNNR. Therefore, within the context of this SA, it becomes more apparent and feasible to analyze and discuss the problems as *"conflicts of interests"* rather than discussing and referring to them as single problems.

As a result, the overall aim of determining one or more alternative solutions can therefore be achieved by comprehensive consideration and discussion of the various conflicts of interests, ambitions, and subjective perceptions rather than solely being determined by the gaps and incongruence between the existing and desired states of only the predominant stakeholder problems.

Stakeholder Interests

According to CAMPBELL and MARSHALL (2002: p. 165), “interest” can be defined in two different ways. Firstly, the concept is stated as “*having something at stake*”. In this case it is not bound to a specific subject but instead used as a term that can be both subjective and/or objective. Therefore, it can represent both individual wishes as well as a political dimension which can be referred to as public interest.

Secondly, the term can be defined in the context of having an interest *in* something: “*It relates to a concern with or attention to something*” (ibid: p. 165). In this definition, interest refers purely to the subjective perception of an individual or a group, based on the subject’s own particular wishes or feelings.

Considering the stakeholder analysis presented in this report is based on a survey conducted through interviews which presumably reveals mainly subjective perceptions, the second definition will be used as a basis for our analysis.

That the interviewees are truly able to know and properly communicate their interests to the interviewers is another imperative assumption. Furthermore, it can be asserted that only the respective individual can know his or her interests, as it is postulated for instance in utilitarian writings (PITKIN 1967). Such considerations outline the benefits of carrying out stakeholder analysis, especially in the circumstance of governmental actions where the interests of its citizens are acknowledged before implementing new regulations and policies.

Supplementary to the importance in the definition of interest, is the understanding of the term ambition, which is according to the OXFORD DICTIONARY: “*A strong desire to do or achieve something.*” In this report, the term ambition is utilized to identify more particular and clearly defined plans for the future, while interests refer to more vague or general aspects communicated. The explanations, assumptions and benefits discussed in the previous paragraph explaining the term “interests” apply also to the term “ambition.”

It is important to acknowledge that there is often no static set of interests and ambitions for stakeholders. They must therefore be interpreted as individual parties according to KAHNEMANN et al. (2006):

- Interests and ambitions that can be complex and dissimilar
- Interests and ambitions are likely to change and evolve over time in reaction to different circumstances and situations
- Perception of ambitions and interests are highly context-dependent, thus making respective statements less representative for an overall description.

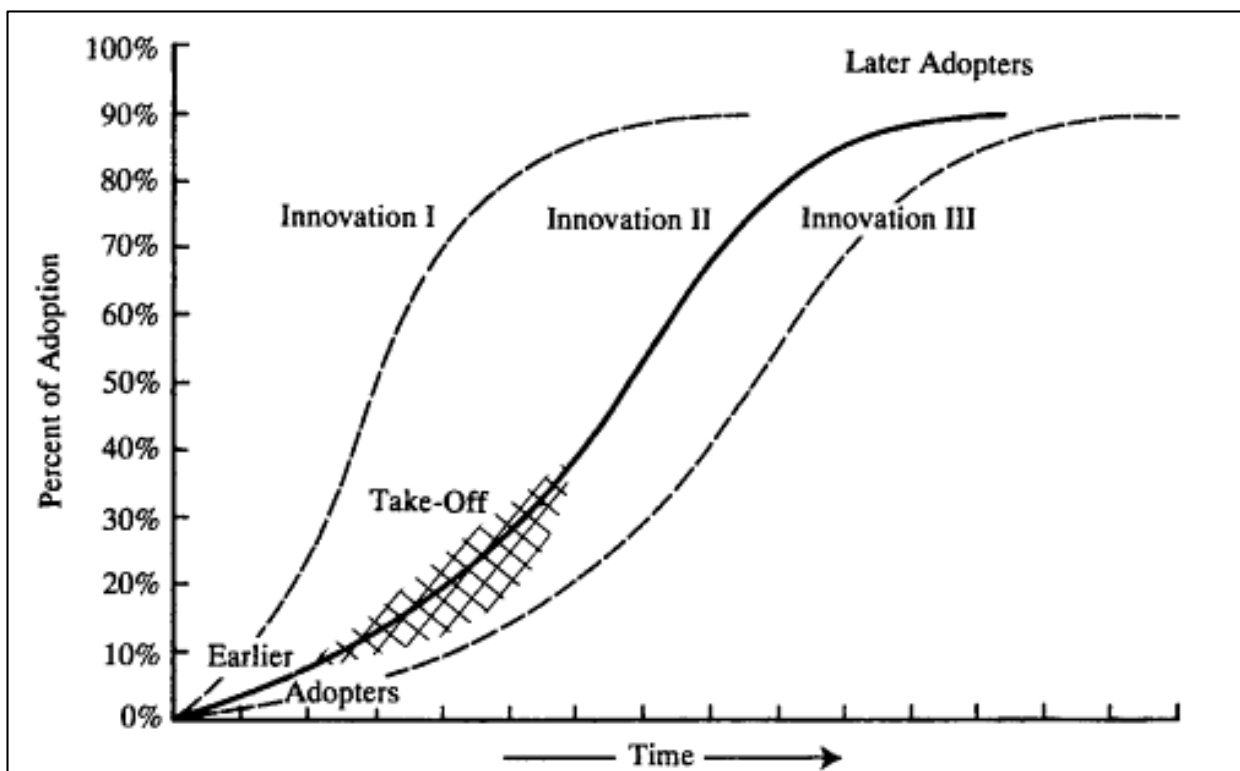
Understanding these terms and concepts foster the ability to create a more comprehensive and relevant interpretation and analysis of the interests and ambitions of the study group,

without compromising on the accuracy of information obtained or neglecting the uncommon interests of stakeholders. Moreover, it also provides a framework on how to approach research and analysis of stakeholder problems, again without excluding potential complexities and variables involved in the results.

Diffusion of Innovations

ROGERS' model *Diffusion of Innovations* explains how an innovation is spread and implemented in a social community, as shown in Figure 6. According to ROGERS (2003) "... *diffusion is a special type of communication concerned with the spread of messages that are perceived as new ideas*". Four main elements can be determined in every diffusion research study: (1) an innovation, (2) a communication channel, (3) a time period and (4) a social system.

Figure 6: The diffusion process



Source: ROGERS 2003: p. 11

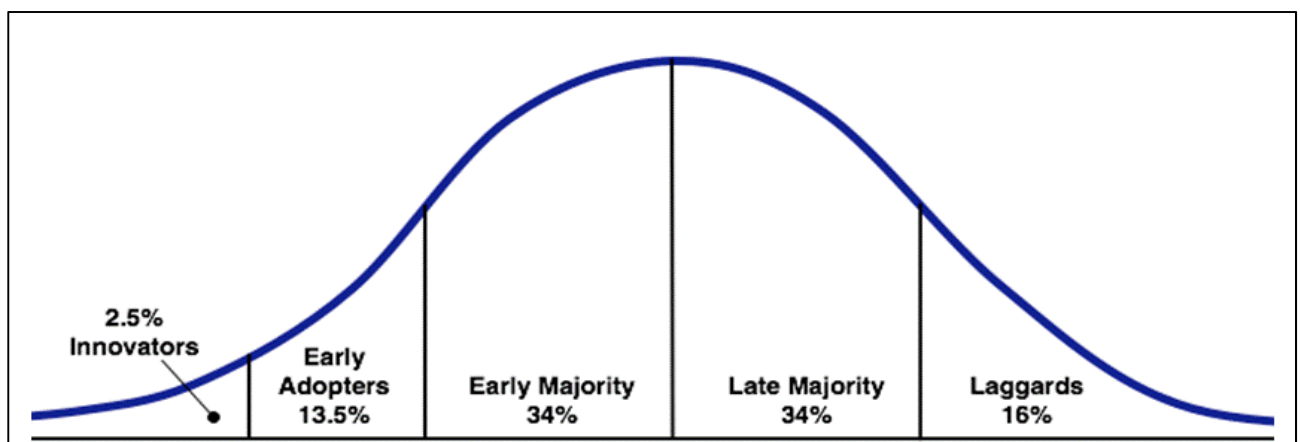
"Communication is a process in which participants create and share information with one another in order to reach a mutual understanding" (Rogers 2003: p.35). The model also explains that due to the fact that the idea is new, participants might react pre-cautious concerning emerging risks.

An innovation is defined as an "...*idea, practice or object perceived as new by an individual or other unit of adaption*" (ibid.: p.36). Innovations are classified depending on their degree of implementation. ROGERS defined five different categories: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability.

The new idea, or innovation, is spread from one person to another through the communication channel. There are different channels which can be distinguished, whereby “... *mass media channels are more effective in creating knowledge of innovations, (...), interpersonal channels are more effective in forming and changing attitudes toward a new idea*” (ibid.: p. 36).

Time includes *the innovation-diffusion process*, the *innovativeness* and the *innovation's rate of adaption*. The last element is the social system with the interrelationships of the members in order to solve problems and achieve shared goals. ROGERS has specified individuals into five different categories in relation to their time of adoption of the innovation. The “classifications of the members of a social system on the basis of their innovativeness: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards” (ibid.: p.37).

Figure 7: Adopter Categorization on the basis of Innovativeness



Source: Rogers 2003; p. 281

The innovators are individuals who are steadily interested into new ideas and willing to take risks. They have certain communication patterns and are able to understand complex technical mechanisms. Since the innovator introduces new ideas he is the gatekeeper in a social community.

The early adopters are the opinion leaders and thus the most influential people in a community: “*They reduce the uncertainty concerning new ideas by adopting it*” (ibid.).

“*The early majority adopt new ideas just before the average member of a system*” (ibid.). They are not always accord with the early adopters but are an important link in the system.

The late majority is rather risk-averse and critical about new ideas. They implement the innovation mostly due to economic reasons or rising peer pressure.

The laggards are very reactionary and the last group of people in a community adopting the new idea. Many of the laggards are socially excluded and they are still very attached to the past.

2.3 Communication Networks

2.3.1 Definition of a Network

Social networks play an integral role in the dissemination of information related to rural livelihood. There are many levels of actors who influence knowledge dissemination and composition of networks.

According to KADUSHIN (2004) “*a network is a set of relationships*”. The theory of networks can be seen as analogous to the phenomena found in physics. When approached from this viewpoint the complexity of the concept is simple to grasp. In the study of networks, researchers observe the objects in the system and describe or map how they are interrelated. In general social network theory states that these objects can consist of, among other things, individuals, groups, organizations and even websites. These objects are referred to as nodes which are then linked through vectors describing the direction and nature of the relationship. Approaching the concept from a broader perspective allows an overview that captures the visual as a whole, enabling a general pattern to be observed and information about the logistics of the network extracted.

2.3.2 Components of Communication Networks

Within the framework of this study, the key influential components of networks have been identified as being the nodes, the links (interrelationships between nodes and other components) and the web (understanding the web of human interaction).

The Node

The nodes of concern are local villagers. Here the interrelations studied are clustered around the rubber monoculture, with information flows acting as vectors between actors. In order to simplify the description of the network as a whole, a discussion of specific aspects of each one of the components is outlined.

Analysis of a node in itself is controversial as many theoreticians argue that it is more the transmission and the position of the node with respect to others that is important, and not the characteristics of that node as an individual. This study takes an integrative stance; one acknowledging that individual agency is indeed of relevance and that much of the individual is defined through the relationships with other individuals (COOLEY 1956). The former aspect is especially relevant when assessing the interests of stakeholders as presented in Chapter 2. Unique attributes such as the ethnicity, age, religion, race, class and family status can *ceteris paribus* give researchers an idea about what kind of knowledge is possessed by the individual.

Inherent qualities can also set a node apart, for example a regulatory body with the power and resources to make transactions with a large portion of the network, or a village head who has the responsibility to inform and regulate events according to the administration. These bodies are given responsibilities that define what sort of role they must take in interacting with others.

Roles that are formal or informal and external or internal prescribe the characteristics of the node fulfilling that role. Frequently, those that have a concrete role are influential and often function as an intermediate node. This is a special trait that links two actors together. The connection and correlations between actors is described in more detail within the next section.

The Link

The interrelationships between nodes of communication networks are especially important to distinguish due to its ability to provide researchers in nearly all disciplines the essential information required to hypothesize about potential occurrences in the future. Although found to be a useful tool for identifying trends, the general structure of the web network is by contrast often too complicated to use as a tool for understanding how things interact.

The simplest relationship between two entities is at the dyadic level and many variables can affect the way that the nodes in the pair relate. Usually, pairs relate to one another in a socially relevant way when they have something in common, this can be referred to as *homophily*. Social status and mode of thought were established as subcategories in the classic paper of LAZARFELD and MERTON (1954) and a relevant summary describing the influence of the former on the latter can be found in MCPHERSON et al. (2001).

What is more interesting in this particular case is the cause of such homophily. In KADUSHIN's (2004) work two main causes are explained in being affected by or affecting the attribute of the agent. These are the structural location and the norms. As such, the causal relationship between status and values is paralleled in the correlation between the location and strength of the norms.

This correlation is influential when considering official ties, such as administration or contractual relationships. Approached using the same logic, it is more likely that such formal interrelationships are successful when homophily exists. If the policy makers, renters, landlords, factory owners, etc. understand the interests of the various actors and tailor their agreements to the common interest, the resolved transaction is less likely to result in conflict. It requires a sizeable investment of resources to understand the attributes of each group when the actors do not share similar backgrounds. However, depending on the relationship, such investment proves valuable. Examples of valuable results obtained through cooperation include solutions that benefit ecological conservation, economic efficiency, and social integration.

The Web

Although simple dyadic ties are helpful in understanding how nodes interact, in reality, the web is a more appropriate tool for reflecting complexity of relationships of human interaction. When more actors are incorporated into a project, a more widespread account of the network is required, thereby enabling a more comprehensive and inclusive study of the network, with as many characteristics and factors being assessed. According to MITCHELL (as summarized by KADUSHIN 2004: p. 1969) the distance between two nodes is determined by four factors:

1. The size of the first order zone of nodes in the network;

2. The quantity of overlaps within the interpersonal environment, henceforth referred to as dimension;
3. Any barriers between nodes;
4. Agency exercised by the nodes.

The larger the first order zone, the more familiar the people in the network are with each other. It is logical that in larger networks it is harder to form relationships with everyone and the degrees between nodes may become more complicated as nodes are linked through more and more intermediaries. In local, somewhat isolated networks the network can be so small and so established that the entire network is a first order zone, hence fully connected. This leads to the transitivity aspect of the web. Whereas the degree distribution refers to the number of social ties, transitivity refers to the likelihood that two of a person's friends are in turn friends in a sense

Barriers between nodes can skew the shape of the network, either accounting for the flagging of certain transactions and the strengthening of others, which in turn widens or shrinks the distance between actors. For example, a development program might facilitate market access for small holder farmers. Whereas previously, farming communities had to cooperate in order to get their products to market because of high transaction costs (transportation, time, labor, etc.), this new legislation could decrease the dependence of farmers on one another. While the relationship between farmers might be diminished it could also allow for the individual farmers to come closer to the consumer.

There are many possible types of barriers that include demographic, geographic, political, logistical, and moral issues. People's ability to overcome these barriers and make connection relates to the amount of agency or motivation an actor has. Actively seeking to increase the quality and amount of connections despite barriers is a sign of the willingness of the actor to change the status quo.

However widespread, the many multifaceted factors and complex relationships requiring consideration in research and development programs must be clearly postulated, evaluated, identified, and simplified to maintain and collect as much as possible data that is consistent, relevant, and comprehensive. Through carrying out stakeholder analysis, situational analysis, and understanding important components in communication networks, research and development programs increase in their ability to be efficient and relevant.

2.3.3 Types of Networks in Rural Development

Attributes of Local, Rural Networks

The small size of the villages and their remoteness makes homophily and transitivity key in understanding the communication dynamics of rural villages in Xishuangbanna. Self-sustaining, geographically integrated areas must have networks that are highly reliable. Villagers' dependence on one another strengthens the individual's identity within the group and typically one adheres to the norms that are established. In rural areas, this common social platform leads to many types of informal ties. High frequency of interaction, accountability of parties and strong social forces maintain these linkages. Indeed these links can form in more than one way. Multiple connections between nodes, or multiplicity, is necessary in a community with a small population and many tasks to complete. For example, a neighbor

could be a trustworthy friend, an in-law and a newly informed rubber tapper, at which point she becomes an informant for technical information and simultaneously maintains her social roles. When kinship ties and inter-subjectivity, or mutual relationships, is taken into account in small communities, it is quite obvious to note the gross zone of first order connections and dimension in these networks. There are many variables that hold informal networks together and assure their function; however there are large effects of external and formal relationships on these informal ties common in rural, local networks.

As globalization continues to gain momentum, even the most rural areas are becoming not only accessible but quickly reachable. The local component of these networks is still important but new relationships with outsiders (i.e. rubber factories) can quickly evolve. As the distance between actors shrinks it is more likely that once secluded areas are now being influenced by the growth-oriented world. Not only does proximity in terms of kilometers matter, the communication tools that enable rural people to contact nodes once worlds away, have diffused quickly and are being used for both social and entrepreneurial activities. The increased speed of communication is enabling rural peoples to inherit scientific and economic knowledge that has a direct effect on their livelihood.

Another reason for new external ties is that formal terms of agreement are possible and institutional backing is available in case a contract is violated. The perspective of the typically skeptical, rural actor is changed because the nascent node is able to offer a relationship with an equal or lower amount of risk when compared with his neighbor. Many rural peoples are no longer self-sustaining because they are more easily able to specialize their labor force and trade with less familiar nodes. Without this dependence on the structural location, it is likely that there will be a change in the functionality of first degree connections and that the network will change shape. The rural, local network is quickly changing; however it is clear that villagers are still quite reliant on one another for information, community service, and comradery.

Functional Network Characteristics

Strong combinations of compatible nodes make for a functional network. As explained in the theory section, homophily increases the likelihood of a relationship but it also contributes to the quality of the connection. Common issues and interests paired with low barriers between nodes leads parties to collaborate and, in some cases, to better their wellbeing. Obstacles are reduced when parties are available to communicate, actors engage with one another, interpersonal relations are created and when the tools used function. The failure of one of these components doesn't necessarily mean that the link will disappear, however the maintenance of these components will more likely lead to progress.

Dissemination of information

The linear transfer of technology (TOT) classified as a one-way knowledge flow, has been replaced over time by the Agricultural Knowledge and Information Systems (AKIS) model. AKIS was developed at Wageningen Agricultural University in the late 1980s (RAMIREZ 1997). The model contradicts the linear information dissemination systems of TOT and is a two-way exchange of information that is crucial for effective generation and transfer of relevant technology. The method Rapid Appraisal of Agricultural Knowledge Systems (RAAKS)

is a management tool established by ENGEL and SALOMON (1994) for understanding agricultural knowledge systems in a participatory manner. RÖLING (1990) defines the best extension systems as those where farmers are organized and able to lobby for technical assistance suitable to their needs (RAMIREZ 1997).

Meetings with farmers and other stakeholders, the study group followed methodology of both AKIS and RAAKS. In the paper by RAMIREZ (1997), research was conducted in the Philippines, Ethiopia, and Peru, exploring network analysis from the user perspective, mapping AKIS from the farmer level up. The first stage of their research was methodology used in our meetings in the villages involving the following six activities, which have previously been described in the Methodology chapter:

1. Identification of the farmer
2. Community mapping
3. Ranking of major enterprises
4. History of innovation
5. Discussion and Verification
6. Follow up interviewing non-farmer groups

Social Networks

Families, kinship, and personal relationships with friends also are forms of networks for sharing information on rubber. WARRINER (1992) has conducted research on conservation tillage and on whether factors of kinship are related to adoption of farming practices. In his research he references CARLSON and DILLMAN's findings on kinship and adoption, which show both positive and negative consequences of decision making. In their study they found that most farmers operate their farms with a spouse or in a combination of kinship. Both intergenerational (father and son) and sibling/peer relationships have been shown to limit the likelihood of adoption due to similarities and views about conservation tillage. However, their study also showed that kinship may encourage adoption of new methods, as added and more frequent communication results in more rapid decision making. Also cited in WARRINER's (1992) research is BULTENA and HOIBERG who report that adoption of conservation tillage is positively associated with received social support among friends and neighbors, but negatively associated with decisions related to information from departments of agriculture or university extension.

3 Methodology

The purpose of this chapter is to describe the phases and steps followed for the Master Student Project in the Naban River Watershed National Natural Reserve. Starting from the design of the project Phase I, Analysis of the study area Phase II, preparation of Data collection *in situ* taking place in China Phase III and finally, the analysis of results and report writing as the Phase IV.

3.1 Research Project

This research project at Humboldt University (HU) conducted a Stakeholder Analysis which contributed to the research process of the SURUMER consortium, specifically within the Sub Project 8: “Knowledge transfer and interaction management”. The SURUMER project is a research consortium whose overall objective is developing an integrative, applicable, and stakeholder-validated concept for sustainable rubber cultivation in southern Yunnan (SURUMER 2011). The project integrates nine different sub-projects, one of which is Sub-Project 8 dealing with the management of stakeholders’ processes and one particular focus in the analysis of stakeholders backgrounds.

As partial requirement of Sub-Project 8, a baseline study was conducted, with combined tools of participatory and rapid rural appraisal, an integration of multidisciplinary analysis and the results of the baseline survey, as well as the first stage of a stakeholder analysis which will be explained in Chapter 6.

Picture 2: The research team



The research team consisted of 12 students from two Master programs at Humboldt University of Berlin: Integrated Natural Resources Management and International Master of Sciences in Rural Development. The diversity of student’s backgrounds and nationalities is a virtue of the research.

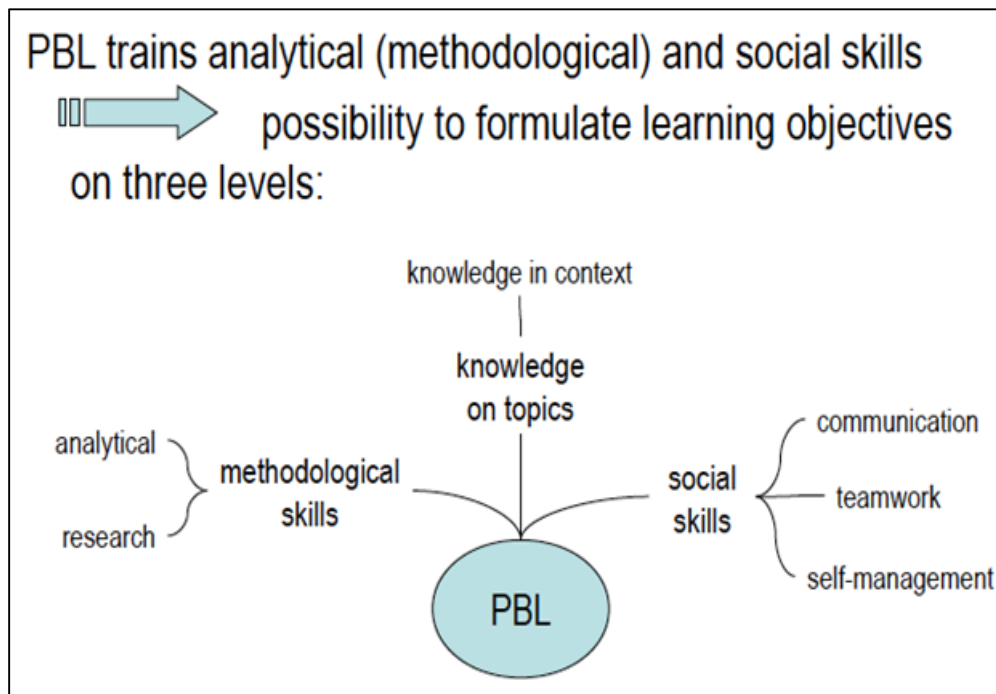
3.2 General Approach

In recent years there has been a rapid expansion of new participatory methods and approaches in the context of agricultural research and development. Participatory methodologies allow scientists and other outside professionals to learn with, by and from farmers, food workers, and citizen consumers. They can help create a working relationship in which people's priorities and values become more fully expressed in the production of new knowledge and technologies (CHAMBERS 1994).

3.2.1 Problem-Based Learning

Developing, conducting analyzing and reporting this research was done according to the principle of Problem-based learning (PBL). Problem-based learning guides learners to discover knowledge on their own, by confronting the problem directly and activating their knowledge with very little initial content given; learners are responsible on their own learning and get encouraged to learn in a more concentrated way (CHAN 2008). The central concept of PBL is that one may learn content effectively while attempting to solve problems (ENGEL 1991). PBL seeks to provide multiple models of action, knowledge reasoning and reflection, together with the opportunities to challenge, evaluate and interrogate. Social skills, in particular, are strengthened.

Figure 8: Objectives of Problem Based Learning

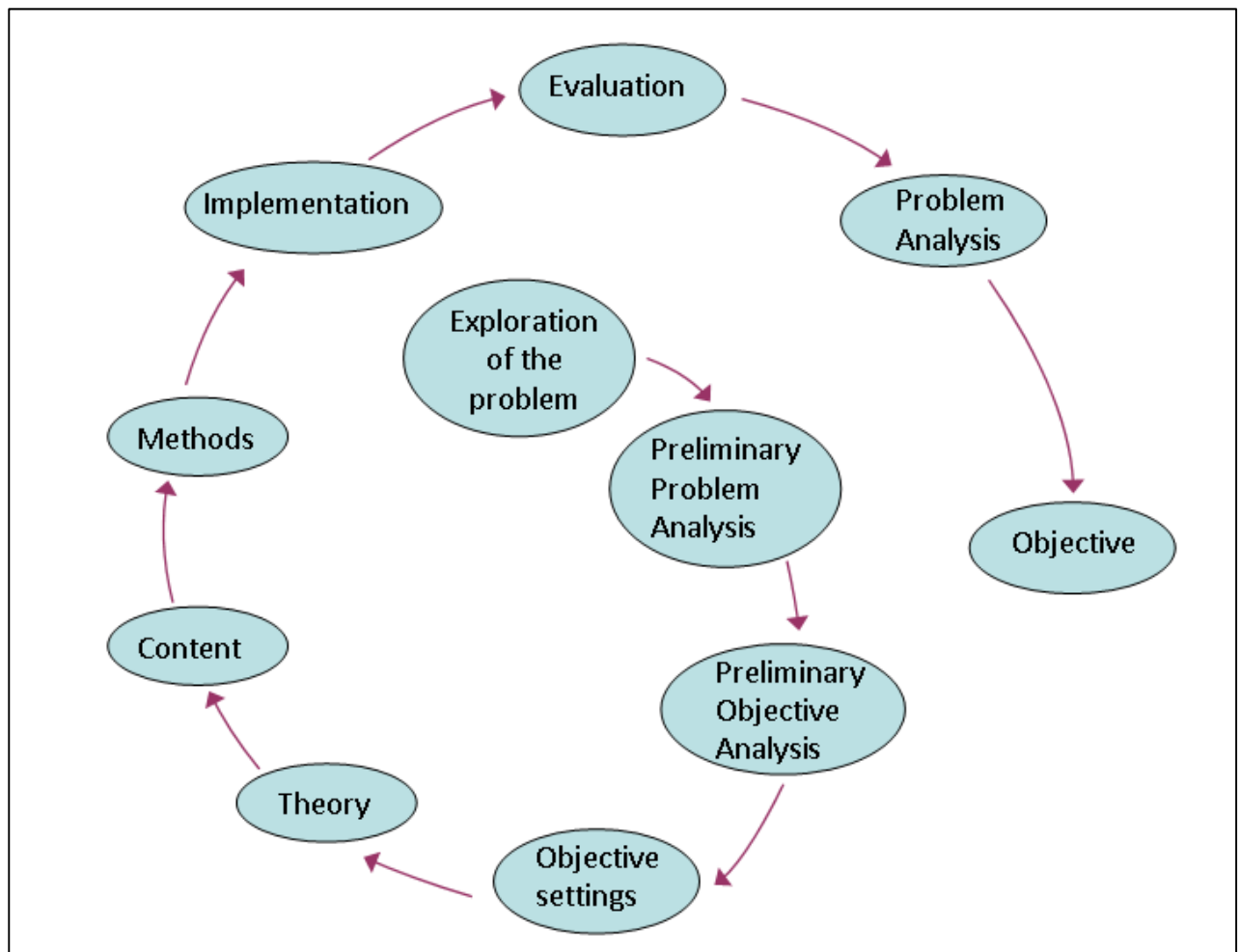


Source: HOFFMANN-SOUKI 2012

3.2.2 Project design

According to GOSLING (2006), a project cycle or spiral shows how ideally a project should be developed, as well as implemented and evaluated, as displayed in Figure 9. It is made of experiences, achievements, review, and also feedback failures; thus, made of several phases which contribute to the visualization of a whole process. Each achievement or experience from one phase may influence the next activity.

Figure 9: Project design visualized according to the concept of the Project Spiral



Source: GOSLING 2006: p.6

The project in general has been worked out in three main phases:

1. Conceptualization and delimitation of the project: This phase consisted of the presentation of the project by the senior researcher, the exchange of ideas and possible questions, definitions of participants and establishment of common interests, and first agreements.
2. Analysis of the study area: A first measure was the introduction to the study area previously defined by the consortium (political background, land tenure, geographical location, environmental characteristics, population and ethnicities, general conditions of access to the study area). This was followed by the predefinition of methodologies,

the selection of cases and the most suitable tools and methods. Special considerations were given to field work (definition and description), the analysis of the current situation to identify the starting points for the project), the preliminary definition of Stakeholders, and the preparation of interview guidelines.

3. Field Research. After arriving in China (Jinghong), a meeting/get together with the student colleagues from the Chinese Agricultural University (CAU) has been arranged in order to
 - Present and update the program;
 - Organize mutual agreements related with Humboldt University (HU) objectives and CAU objectives
 - Recognize the study area (language, facilities, limitations, other issues)During a meeting with the NRWNR representatives the following day, field research and last details have been arranged. Further elements of this phase are arrival and living in the villages, and certainly the survey itself.
4. Analysis of results and report writing: The main tasks of this phase were Review and feedback, Presentation and evaluation of the findings, and the report.

Exploration

According to the concept of the project spiral, first it is necessary to identify possible problems in the study region based on literature. At the first meeting for the project, basic literature and information about the study area was provided, via the Moodle platform linked to the project space. Furthermore, each member of the group was authorized as an administrator of the space, which mobilized the information exchange as well as the communication flow. A project concept was designed, namely, the exploration into the *possible* problems. The student group decided to set up small topic introduction groups in order to organize the information and present it during the next sessions. Such activities allowed for a first glance at the area of study, as well as its economic, environmental and historical profile. Then, based on the collected information the group decided to develop a *preliminary problem analysis*.

Preliminary Problem Analysis

This is a hypothetical analysis, where tentative results can be identified. According to Mohr (1996) the problem analysis focuses on the issue of former problem solving decision making. Problem analysis identifies the negative aspects of an existing situation and establishes the 'cause and effect' relationships between the problems that exist. It involves three steps:

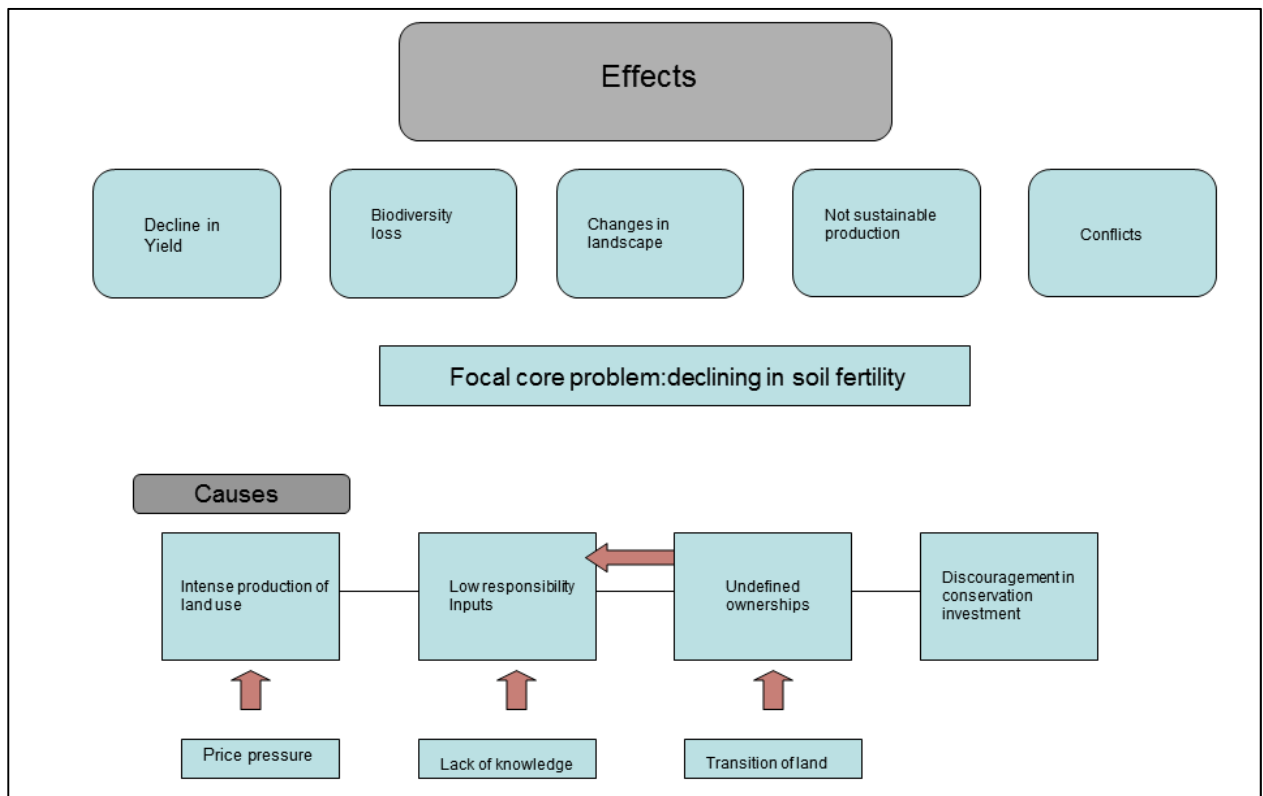
1. Identification of the stakeholders affected by the proposed project
2. Identification of the major problems faced by beneficiaries
3. Development of a problem tree to establish causes and effects

The analysis of problems is one of the milestones to define and focus on, in order to follow a structure and fulfill the tasks, thereby the group decided to use the *problem tree* analysis. An example of one of the five problem trees can be seen in Figure 10.

Problem tree analysis

A problem tree analysis (DFID 2003) sets up cause (roots) and effect (branches) to ensure that the root problems (core/focal problem=trunk) are identified and addressed whereas objective tree is an instrument that helps to analyze and break down the objective graphically into smaller and manageable parts.

Figure 10: Example of a Problem Tree Analysis



Objective analysis

This is a hypothetical analysis of the regional objectives with the aim of preparing the bases of the research project. The formulation of objectives should avoid vagueness; the more specific an objective is formulated, the higher the opportunity that this will lead to a specific outcome. Measurable, viable and clear objectives are basic for an effective program planning and a successful project (MILLER 2011).

Content definition

Six main research questions were defined:




1. Who are the stakeholders and what is their role concerning rubber cultivation?
2. How do stakeholders receive and disseminate information of rubber cultivation?
3. What are general problems of the involved stakeholders?

4. What are general problems of the involved stakeholders concerning current land use systems?
5. Do stakeholders realize environmental impacts/ changes in recent times and how do they explain them?
6. Which alternatives are considered by stakeholders besides rubber cultivation?

Development of the Stakeholder Analysis

On the basis of the problems and objectives analyses, the influential people regarding rubber cultivation in the NRWNNR villages were identified. Figure 11 condenses the activities developed for the stakeholder analysis according to the stages of the methodology (horizontal axis) and the research logic on site and off site (vertical axis).

Figure 11: Preliminary Plan of the Stakeholder Analysis

Research Logic	 Step 1: Identifying stakeholders	 Step 2: Differentiating between and categorizing stakeholders	 Step 3: Investigating relationships between stakeholders
Before field research	Identification of who the social groups and actors involved in the rubber value chain at village level are.	Defining variables: Length in cultivating rubber, farm size, trainings received, social networking access, other income sources, etc.	Literature review about local networks in NNNR villages and the dissemination of rubber cultivation information and knowledge.
During field research	Asking stakeholders themselves about who they perceive as influential people in rubber cultivation at village level	Recognition of stakeholders' roles, interests, problems, agenda and decision-making process	Inquiring and mapping about communication and social networks

Firstly, some relevant stakeholders were identified based on the value chain of rubber production, namely suppliers of seedlings, fertilizers and pesticides, rubber farmers, family of rubber farmers, hired workers, extension services officials and village traders. Since the NRWNNR (as natural protected area) has regulations and restrictions the NRWNNR officials and villages heads were included. However, due to prioritization of stakeholders, those who do not interfere directly on the decision-making for the rubber management or in the setting of biodiversity conservation measures were excluded. Thus, rubber farmers, village authorities, NRWNNR officials and hired workers were defined as key stakeholders.

The categorization of stakeholders was done according to their interests, problems and agendas. Tools such as power vs. interest grids and the model of innovation adoption were also used.

Lastly, the investigation of patterns of interaction and dependence between stakeholders focused on the assessment of their power and its sources, and the dissemination of information and knowledge among the social networks are identified (see chapter 8).

3.2.3 Survey Methods

The baseline survey utilized some instruments of Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) such as:

- Semi-structured interviews
- Villages walks and observations
- Communication networks mapping
- Village maps
- Timelines

Picture 3: Village mapping in Kemu village



Participatory Rural Appraisal (PRA) is a tool that is used in the field to collect the qualitative data, identifying the problems and causes and analyses the possible solutions and conditions. PRA has been depicted as a growing family of approaches and methods to enable local people

to share, enhance and analyze their knowledge of life and conditions, to plan and to act. (MASCARENHAS 1991). *Rapid Rural Appraisal* (RRA) has a similar technique like PRA but it is more cost effective and used to analyze the needs of the rural communities quickly. PRA has commons principles with RRA such as learning directly from the local people, counterbalance biases, optimizing trade-offs, triangulating and seeking diversity. Besides the commonalities, there are also differences between PRA and RRA as shown in Table 1.

Table 1: Comparison between PRA and RRA

	RRA	PRA
Period of major development	Late 1970s, 1980s	Late 1980s, 1990s
Major innovators based in	Universities	NGOs
Main user	Aid agencies Universities	NGOs Government field organizations
Key resource earlier overlooked	Local people's knowledge	Local people's capabilities
Main innovation	Methods	Behavior
Predominant mode	Extractive-elective	Facilitating-participatory
Ideal objectives	Learning by outsiders	Empowerment of local people
Outcomes sought	Useful information, report, plan, project	Sustainable local action an institutions

Source: CHAMBERS 1994: p.958

Types of Interviews

The qualitative interview is a principle research tool often used by sociologists, educators, political scientists, public administrators, social workers, anthropologists and historians. It is used in order to learn about the problems of the stakeholders involved (MARSHALL and ROSSMANN 1989). Qualitative interviews are important in order to find out about the ways people describe how they understand the world in which they live and work. People who live or work together or have similar racial, ethnic, or religious backgrounds develop shared understandings that are communicated to others in their group that constitute their culture. Qualitative interviews also explore specific topics, events, or happenings. Interviewers can solicit personal histories to examine social and political phenomena (RUBIN 1995).

Semi-structured interviews are also known as non-standardized and are frequently used in qualitative analysis. In this kind of interview, the interviewer does not do the research just to test a particular hypothesis (DAVID and SUTTON 2004: p. 87). During the interviews, the researcher will have a list of specific topics, issues, and questions to be covered, which is often referred to as interview guide. Additional questions which are not included in the interview guide can be asked. All of the questions which cover several topics will be asked and a similar wording must be used from one interviewee to the other. In this type of interview, the researcher has more opportunities to prompt and probe for views and opinions of the interviewee. Probing is a way for the interviewer to explore new paths which were not initially take into account (GRAY 2004: p. 217).

Unstructured interviews are non-directive and flexible. It is a more casual type of interview compared to structured and semi-structured interviews. The researcher does not have to fol-

low a detailed interview guide as there are no restrictions. Respondents are encouraged to speak more openly, honestly and provide as much information as possible to the researcher. Problems will arise in this interviews if the researchers are not experienced in the interview process as they may not able to obtained the information that are relevant to the research.

In *non-directive interviews*, the topics are not determined in advance and the interview questions are usually not pre-planned. The interviewer is the listener and the interviewee will be the one leading the conversation. The interviewer follows what the interviewee has to say. In this interview style, the researcher must clearly understand the objectives and topics of the research he/she want to cover during the interview process. The role of researcher is important during the interview process as he/she needs to clarify the unclear points with the interviewee and rephrase the answer to assure the accuracy of data input and understanding (GRAY 2004: p. 217).

The planned baseline survey implied the use of other PRA methods such as village tours, transect walks, mapping, timelines of village history, land use change, village profile chart and festive calendars (SALAS et al. 2007).

Applying the selected interviews methods in situ

During the two weeks, the method semi-structured interview was applied when interviewing village heads, villagers, and staffs from NRWNR.

Picture 4: Semi-structured interview conducted in BanQianDi village



The selection of the interview type was based on the following considerations. Structured interviews, also known as standardized interviews, are quite rigid. In this interview, more intervention from the researcher can be observed and this might influence interviewees to not speak openly and answers from the interviewees may not reflect the true variation. The

researcher is not allowed to give verbal and non-verbal comments and cues which may cause biases and could have an influence upon the replies of the interviewee. The disadvantage of this kind of interviews is that researchers must stick closely to the interview guide.

Four semi-structure interview guidelines were designed, one for each group of stakeholder identified. The structure of the interview followed the six research questions defined with sections that focused on identification of the interviewee, characteristics of the farm and farming systems, problems experienced regarding rubber, other income sources, a special section about land renting, communication networks and future wishes and improvements

The data obtained from the interviews illustrated specific insight of the respective villages, socio-economic structures, land use, land use history and environmental issues. The organization was done as follows: four small groups were formed consisting of three researchers from Humboldt University, one young researcher from CAU who also collaborated as interpreter, one supervisor from Humboldt University and one NRWNNR staff member.

The respondents were selected either through suggestion of the village head or by NRWNNR staff members. During the case study the group often walked from one door to another in the village until meeting someone who was willing to participate in the baseline survey. During the two weeks, 55 interviews were conducted in eight villages within the NRWNNR. Table 2 shows the general characteristics of the respondents.

Table 2: Respondent's characteristics in the villages

Village	# of people interviewed	Sex		Occupation					
		f	m	Rubber farmers	Hired workers	Village head	Forest ranger	NNNR officials	Director of Women Council
ManDian	8	4	4	6	2	1	-	-	1
ChaChang	7	2	5	5	-	1	-	1	-
Kemu	9	4	5	9	-	1	1	-	1
Pabin	6	3	3	6	-	-	1	-	-
ZhongZhiChang	7	3	4	7	-	1	-	-	-
BanQianDi	5	-	5	3	-	1	-	-	-
Huilao	6	2	4	6	-	1	-	-	1
Naban	7	3	4	7	-	-	-	1	1
Total	55	21	34	49	2	6	2	2	4

Based on the objective of the baseline survey, it was necessary that the villages selected have rubber plantations. Eight villages were selected as sampling out of the 32 villages in Naban River Watershed National Natural Reserve according to the agreement with the staffs from NRWNNR. The eight selected villages are represented by the main minorities in Xishuangbanna such as Dai, Han, Lahu, Kemu, and Hani (Akha).

Observation

Observation is a collection of data where the researcher does not participate in the interactions. Observation is known as the “*systematic description of events, behaviors, and artifacts in the social setting that is chosen for study*” (MARSHALL and ROSSMAN 1989: p. 79).

There are different types of observation such as participation observation, non-participation, structured observation and unstructured observation. Participation observation is an active involvement of researcher in the field research. Ideally, observers are open-minded, have a non-judgmental attitude and are interested in learning more about others (DEWALT and DEWALT 1998). Participant observation can be time-consuming and costly as well, as it can take a long time to reveal the hidden meanings of the situation or context in the research area.

In non-participation, the researcher will be the listener and observe the interviewee without their knowledge and without any intervention. For this kind of research, the researcher should be more attentive and focused as compared to the participation-observer.

Picture 5: The first walks around the village in ManDian



Unstructured observation is the first phase of the research, where the specific aspects of topics or behavior to observe and the procedures are set. Structured observation is comparable to an interview with a survey; specific guidelines are followed. Certain aspects to observe are generalized in this part to assure reliability and validity.

The research team did have the opportunity to attend local festivals. On International Women's Day, two groups participated in a local celebration. In ChaChang, the community gathered to slaughter a pig, eat, and drink. At this occasion, the agricultural and forestry depart-

ment representatives came to the party, but it seemed as though discussion on agricultural production was not the focus of conversations, rather drinking and smoking.

Qualitative Content Analysis

Qualitative analysis has its roots in social science. Trying to study why people behave the way they do, their concerns, knowledge, attitudes, beliefs are analyzed. Qualitative analysis allows the subjects being studied to give more detailed answers to questions of the researcher and might provide more valuable insights in comparison to other methods (Seidel 1998).

The *Why* and *How* of decision making are important rather than only the *What*, *When* or *Where*. Hence, it is more important to conduct high-quality interviews with a smaller number of individuals, rather than many low-quality interviews. Most of the time these interviews are used to uncover prevalent trends in thought and opinion that could confirm or disprove our original hypotheses. In order to elaborate a good analysis, it is first necessary to design a qualitative interview.

Picture 6: Preliminary Analysis during the field phase



3.3 Limits of the Methodology

While efforts were made to realize a representative sample for the interviews, some biases could result due to the following reasons:

1) **Seasonal bias:** Conducting field research during off season in rubber tapping facilitates reaching farmers at home or with some free time to share with us their opinions about rub-

ber cultivation and their social networking. However, some disadvantages were the unavailability of some stakeholders that were not in the village (for instance, more hired workers or village traders) and the impossibility to observe directly the tapping, collecting and selling process of latex.

2) **Hierarchical bias:** Due to the fact that most of the interviews were arranged by the NRWNNR officials, respondents were generally part of the economic and political elite of rubber farmers. However, it must be acknowledged that NRWNNR authorities tried as much as possible to contact people with the characteristics that we were interested in or those who were mentioned by other stakeholders as the most involved or influential. Indeed, finding hired workers and convincing them to converse with us was one of the most time-consuming activities in which the team received total support from the NRWNNR staff and village head.

3) **Gender bias:** Despite the use of participatory methods as a gender-neutral concept, reality may be too complex to avoid biases at macro and micro social level.

4) **Interpretative bias:** Recording responses and reactions about topics addressed during the interviews and conversations becomes more complicated when a translation is needed, and even more when two translations are required. Therefore, although there was a constant effort to confirm the information by asking again in a different way, there can be bias regarding interpretations and translations from local languages to Mandarin and finally to English.

4 Introduction to the Study Region

4.1 Geography and Environment

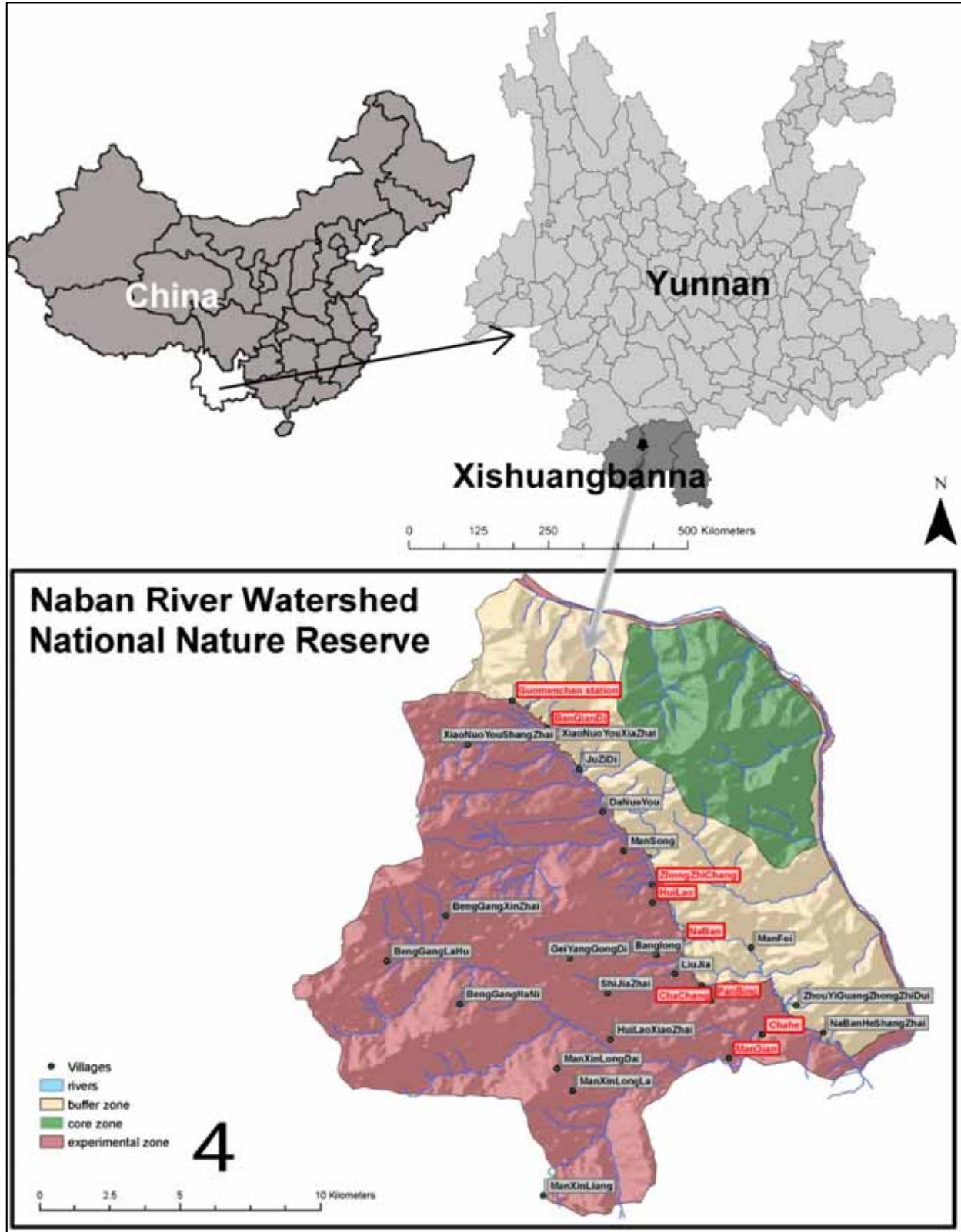
This baseline study was conducted in the Naban River Watershed National Nature Reserve (NRWNNR), located in the central-north of Xishuangbanna Dai Ethnic Autonomous Prefecture in the southern Yunnan Province in China (Figure 12). The area is located about 25 kilometers outside of the Prefecture's capital city, Jinghong. The NRWNNR was established in 1991 by defining the catchment zone of the Naban River as the new protection area. The aim of the reserve is to combine livelihood areas for local villages with environmental protection following the approach of the Man and Biosphere Network of the United Nations Educational, Scientific and Cultural Organization (UNESCO) (WEHNER 2011: p. 44ff). Therefore the territory, with a size of 266.6 km², is divided into three different zones (Figure 12):

- A core zone (green), in which human land use is prohibited and where most of the natural rainforest is located;
- An experimental zone (red) where most of the villages are located and agricultural activities prevail. Most activities except for large construction sites are permitted;
- A buffer zone (yellow), which lies between a) and b) and where research and certain interventions are permitted for local villagers. Residents must apply for permit prior the activity (TANG 2013; GHORBANI et al. 2012).

The NRWNNR terrain is fairly mountainous with altitudes ranging from 539m to 2304m above sea level. Land with slopes greater than 25 degrees accounts for more than 80% of the total area, hence flat space is limited. Manifold meso-climatic conditions occur in the protected area mainly due to its mountainous relief and the large differences in altitudes (WEHNER 2011: p. 44ff). On average, the annual temperature range is 18-22°C and precipitation is between 1100-1600mm. The rainy season is from May to October. In altitudes lower than 800m laterite soil types can be found. Red soils prevail in altitudes higher than 800 meters (TANG 2013: p. 50ff.).

Xishuangbanna is still perceived as a biodiversity hotspot. Eight vegetation types can be found: tropical rainforest, tropical monsoon forest, evergreen broad-leaved forest, deciduous broad-leaved forest, warm-temperate coniferous forest, bamboo forest, savannah and shrub (WEHNER 2011: p. 45). In the NRWNNR more than 300 species of invertebrates, over 400 species of vertebrates and more than 2300 species and subspecies of higher plants exist (LIU et al. 2010). These numbers are likely to be threatened. Forest cover has significantly decreased to 50% in 2003, with deforestation most severely affecting tropical rainforest (LI et al. 2008). This is especially true for the buffer and experimental zones, while the largest share of natural forests can be found in the core zone.

Figure 12: The NRWNR and its location within Xishuangbanna, Yunnan, and China



Source: GHORBANI et al. 2012: p. 3

4.2 Social Characteristics

The state owns 74% of the total area of the NRWNNR, e.g. rivers, mountainous forestland especially in the core zone. About 26% of the land area is collectively owned which also contains a high share of natural forest coverage (60%).

In 2004, a total of 32 natural villages in the NRWNNR was inhabited by 5,566 residents with a mean of 40 households per village. Each natural village belongs to one of the five administrative villages ManDian, Daan, Benggan, DaNuoYou, and Naban, which lie in one of the two counties Menghai and Jinghong. The villages differ greatly in terms of size, population density, income and social conditions. One of the factors that is similar in all villages is the household size: 4.3 people on average. The per capita income per year was about 1,794 RMB in 2004. The main income source is agricultural production. The composition of income has changed substantially during the last decades. TANG (2013: p. 55) states that “... *although all are situated in the NRWNNR, different villages have different agricultural industries because different towns and villages possess different policies, capabilities and administrative interventions to develop agricultural industries*”.

The access to infrastructure and telecommunication is often limited, especially for transportation during the rainy season. Eight primary schools in the NRWNNR are responsible for basic formal education.

Picture 7: Elderly couple in ZhongZhiChang



Xishuangbanna is home to a large number of ethnic minority groups. The largest of the six ethnic groups in the NRWNNR is Lahu (50.34%), followed by Hani (23.37%), Dai (11.37%), Han (10.22%), Yi (3.34%) and Bulang (1.35%). According to WEHNER (2011: p. 46) there is a close connection between belonging to an ethnic group and the traditional land use. Thus, Dai are traditionally known as rice farmers and Lahu as shifting cultivators, hunters and gatherers. Other groups have practiced a mix of both land use types. Han migrated into the region in the first part of the 20th century as a result of persecution and adopted the cultivation practices from the surrounding villages.

Some communities have been resettled and villagers have been migrating during the last 50 years due to political, infrastructural, and economic internal and external influences and forces and external aspects of nature conservation. Therefore, only a few of the 32 villages have been existent in the region for a longer period of time. The oldest settlement may have been founded 500 years ago.

Influence of humans on the environment has increased in the last decades as a result of migration, population growth, and modified land use systems (TANG et al. 2009; TANG 2013: p. 50ff; WEHNER 2011: p. 44ff.).

4.3 Village description

In Table 3, villages are ranked by stated income, starting with the financially richest village.

Table 3: Village descriptions

Village	House-holds	Population	Altitude in meters	Ethnicity	Arable Land (mu)	Average income (RMB) /pp/a
Kemu	22	105	Unknown	Kumu	No data	6700
Pabin	39	163	770	Hani	125	6500
ChaChang	29	91	750	Lahu	105	5710
Naban	42	187	690	Dai	480	4970
ManDian	67	289	670	Dai	130	4900
ZhongZhiChang	20	101	690	Han	75	3514
Huilao	42	175	1230	Lahu	291	3113
BanQianDi	10	60	1000	Lahu	133	3084

Source: WEHNER 2007 and own research

The following five villages mainly depend on rubber for their income generation: Kemu, Pabin, ChaChang, Naban and ManDian. Additionally, Huilao and ZhongZhiChang depend on rubber only to some extent, and they were found to have rather diversified income sources. Finally, there is currently only a small dependency found for BanQianDi, since they just began to receive income from rubber in 2012. For further information on villages within the NRWNNR, see chapter 5 and WEHNER 2007.

Kemu

Kemu village was established in 1982. At present there are 22 households with 105 people inhabiting the village who for the most part belong to the Kumu ethnicity. Rubber is cultivated on 2420 mu and the mean annual income per person is 6,700 RMB, which makes Kemu the richest village of the whole research area. The first rubber trees were cultivated in 1984, when the government required each household to cultivate at least 1 mu. Additionally, the villagers have been cultivating dendrobe since 2009 (Village head). The communal land was created for non-farming use in order to protect water, common traditions and to use it as wood resource. Nowadays, the village is surrounded by a state farm, which also offers trainings and seedlings, as several Kemu farmers mentioned.

Picture 8: House in Kemu Village



Pabin

Pabin village consists of three parts. It is around 30 to 40 years old and was moved twice from its original location. Initially, the village was located close to Menghai but the area was determined to be the NRWNR's core zone. As a senior farmer said: *"In 1966 the government moved the village to another location. But access to transportation and infrastructure in the second location were insufficient in 1975, and the village was moved to the present location."*

The village consists of 42 households and one village community house (for meetings and dances). In total, 163 people live in Pabin mostly belonging to the Hani ethnicity. They have an annual income of about 6,500 RMB, making it the second richest village in the research area. There is a communal land area, but it is forbidden to cut down trees due to NRWNR

regulations. Most of the people have livestock and grow vegetables for subsistence (such as pumpkin, carrots, cabbage). All farmers in Pabin were found to plant rubber, however not all are tapping. 100 mu is the biggest area of rubber plantation (Village head and NRWNNR official) in Pabin.

ChaChang

ChaChang lies at an altitude of 750m and was established some 35 years ago. It is inhabited by Lahu people and it used to be a tea producing village. However, tea is not cultivated anymore. There are 29 households and a total population of 91 inhabitants. Rubber is currently cultivated on 735 mu and the average income per person per year is 5,710 RMB.

NABAN

Naban village is around 500 years old (Village head). It is located at an altitude of 690m and consists of 42 households. The majority of inhabitants belong to the Dai ethnic group, with some Han Chinese and Lahu. Rubber is cultivated on 780 mu. The average annual income is 4,970 RMB. Information from the village head and the NRWNNR official shows that the village was connected to the power grid system in 1958 but only recently in 2011 was it connected to roads. Naban village is very rich in flat lands, so the majority has been cultivated with rubber already. Besides planting hybrid rice, in the winter Naban farmers also cultivate muskmelon and watermelon (2013: p. 58).

Huilao

Huilao belongs to the administrative village of DaNuoYou and lies at an altitude of 1230 m. There are 42 households that can be located within the village. The majority of the 172 inhabitants are Lahu with only three Han Chinese living in the village. Information from the village head and a Huilao NRWNNR official suggests that before 1950, villagers lived up in the mountains and were gradually resettled to the present village up until 1990-1991 as the present village is connected to a road and is closer to rubber farmland. The main crops that are cultivated are rice for subsistence use, maize, yams, bamboo, coffee, tea and honey while livestock is mainly chicken, pigs and geese. Even though rubber is being cultivated on an area of 1038 mu, the average income per person is still fairly low with 3,113 RMB.

ManDian

ManDian village is set up by 67 households with 288 inhabitants. ManDian is the most populated of all researched villages and people belong to the Dai ethnic group. Rubber is cultivated on 2098 mu and the mean income per person and year lies at 4,900 RMB. With an average altitude of 670 m, ManDian is suitable for planting rubber. According to the village head, rubber cultivation in ManDian began in 1984, inspired by the ManDian-State farm, which was founded in 1982. Consequently, the mountainous lands are all cultivated with rubber trees so that some villagers are renting land from outside to plant even more rubber. Additionally, the village also cultivates 12 mu of dendrobe.

Picture 9: Buddhist temple in ManDian



BanQianDi

BanQianDi is the only one of the researched villages that belongs to Menghai County. The ethnic group inhabiting the village is Black Lahu. They were transhumant before settling down in 1953 after a governmental distribution of land and forced to lead a sedentary life. The village lies at an altitude of 1000m, at the border of climatically possible rubber cultivation. It is set up by 10 households with a population of 60 inhabitants. According to the village head, villagers only started to grow rubber recently in 2005 which explains the fairly low mean income of around 3,084 RMB per person.

According to the village head and an NRWNR official, Lahu people were living in Naban River, GuoMenShan and HuoNanShan. As no roads were leading to these villages, the government wanted them to move in order to improve their organization. In addition, as the forest is a biodiverse hotspot, human activities should be limited and people were moved to BanQianDi around 10 years ago. While GuoMenShan is in the NRWNR's buffer zone, Naban River and HuoNanShan are in the experimental zone. People received a compensation of about 500 RMB and the roof for constructing a new house from the government

when they moved to BanQianDi. But they claim that the compensations were actually not high enough to start a new living and compared to what they had given up in their old villages.

ZhongZhiChang

Picture 10: ZhongZhiChang



ZhongZhiChang is a natural village which lies at an altitude of around 700 m and belongs to DaNuoYou. The people living in ZhongZhiChang mainly belong to the Han ethnicity and were resettled from the mountainous Dabonggang in 1984, as their old lands were in the area of NRWNNR's experimental zone. It is comprised by 22 households and villagers have been cultivating rubber since 1987. Living standards are fairly high with a mean annual income of around 3,514 RMB per person. Nowadays, all households plant rubber trees which also take the main share in terms of land use. Ten households were found to be renting land from outside the village, namely from Huilao and DaNuoYou Village. The renting schemes are set up for a period of up to 50 years (Village head).

5 Rubber cultivation in Xishuangbanna

The area around Jinghong is characterized by much agricultural activity. With regard to historical changes there has been a shift from cultivating huge varieties of food crops towards focusing only on cash crops like bananas, tea, and rubber. This shift was induced by the government's intention to promote a more market oriented agriculture. In the following section, the most important of these are presented in order to create an understanding of the current agricultural situation in Xishuangbanna and the NRWNNR.

5.1 Land Use policies before 1980's

Currently, China's society is characterized by a wide range of economic and cultural stages. While there is enormous development and growth in the cities, traditions and indigenous knowledge still play an important role in rural areas. The country has faced rapid transformations in different sectors of which economic growth is potentially the most important, though institutional and social changes have also had a substantial influence (TANG 2013).

An individually owned family farm system, which was mainly characterized by its small size, had been the traditional Land Use System in China for thousands of years until 1949 (LIN 1997). Since the foundation of the People's Republic of China in 1949 a main focus in the Chinese policy systems on all levels had always been to improve agricultural development (TANG et al. 2010). The incentive of these strategies, which involved the promotion of new technologies as well as the confirmation of the land property system, was to reduce poverty and strengthen the economic viability of the agricultural sector (TANG et al. 2010).

The first Land Reform in China was implemented from 1949 to 1953 (TANG 2013). The main purpose of this reform was to redistribute the land according to a head count. All rights concerning land use were given to the farmers, meaning they officially became the owner of their land and had the usage rights (TANG 2013). The program was completed in 1952, after the success of the socialist revolution (LIN 1997). By that time agricultural production accounted for more than 50 percent of the national GDP (FAN et al. 2006).

In the 1950s, the Chinese government started to collectivize the land. The idea behind collectivization was to mobilize people from rural areas to work in large-scale projects to promote the industrial sector. Moreover the government believed in improving agricultural productivity through collectivization (LIN 1997). Until 1962, when it became mandatory, farmers were encouraged to give their land voluntarily to the collective communities in which they participated. Since the collectivization approach by the Chinese government was on a voluntary basis in the first phase, there was no strong resistance from the farmers (LIN 1997). In 1958, the Chinese Party began to form People's Communes. The basic function of these Communes was to increase agricultural efficiency by increasing production units. Due to this increased efficiency former agricultural laborers were meant to work in the construction industry in urban areas: *"The average size of a commune was about 5000 households, with 10,000 laborers, and 10,000 acres of cultivated land"* (LIN 1997: p. 204).

The work regulations of the rural People's Communes, which consisted of 60 articles, forced all farmers to participate in the People's Commune in 1962 by collectivizing their property (TANG 2013). These articles built the legal framework for the Communes. People's Com-

munes were organized in production brigades (200-400 households) and production teams (20-40 households) (TANG 2013). Between 1959 and 1961, the Chinese Communal Movement faced a severe crisis due to the fact that production was not as successful as it should have been. As a result, nearly 30 million people died of starvation or malnutrition (LIN 1990 in LIN 1997). Despite this, the collective farming system combined with the promotion of grain, cotton, and other agricultural products were liberating forces for the industrial development of China (LIN 1997). On the other hand though, the outcome of this policy led to poverty among farmers and agricultural workers as well as a misallocation of natural resources (LIN 1997).

The implementation of developed technologies and procedures such as irrigation and chemical fertilizers and pesticides, combined with new varieties of crops had not yielded the expected success. It was in 1978 when this started to change because of a series of reforms in the rural areas of China (LIN 1997). The Household Responsibility System, which granted more decision making freedom to the production teams finally brought the desired effect: Agricultural productivity increased and farm workers got an incentive again to feel more responsible for their actions.

Property rights

Before the first Land Reform in China in 1949, almost half of the arable land belonged to landlords who were renting their properties to farmers and their families. In order to have the right to grow agricultural products on that land the farmers had to pay fees which were “... often as high as 50% of the main crop’s value” (LIN 1997: p. 204). During the land reform period, the Communist Party re-distributed the land of these landlords to the tenants (LIN 1997). Landlords did not receive any compensation for the confiscated land.

As a result of the forest land reform from 1950-1953 all forestland in China was nationalized. Shortly after this reform the collectivization began and in 1957 the first collective forest farms were established (APEL 1997).

In 1958, the Agricultural Production Collective Movement was established in the NRWNNR and in the whole country. From then on the farmers were working together in the fields, which belonged to the village community (TANG 2013). A work-quota regulated the distribution of income that came from the agricultural products from the land.

5.2 Implementation of the Household Responsibility System

In 1979, after the end of the Cultural Revolution and the death of Chairman Mao Zedong the new government implemented a major change in rural policy. Due to the communal systems not being as productive as expected there was a shift towards imposing responsibility back to Chinese households. At that time the Household Responsibility System (HRS) was restricted to the less developed agricultural regions like mountainous areas (LIN 1997). Additionally the political transition seemed to contradict the socialist policy of China at that time (WEHNER 2011). However, by 1981, the HRS was officially recognized throughout the entire country and by the end of 1983 it had reached nearly every rural household in China (LIN 1997). In Xishuangbanna the HRS was implemented around 1980. After a transition phase the collec-

tive land was abolished and transferred to individual households (WEHNER 2011). This transfer also included a change in land use itself. Now, farmers could individually decide about production management on their land. The former People's Communes were transformed into townships. The same happened on other levels: production brigades became administrative villages and production teams then were transformed into natural villages or village group administration (TANG 2013). The HRS accompanied a land classification campaign. This campaign distinguished between state and collective land (WEHNER 2011).

Property rights

After the initialization of the HRS, the collective land was distributed to the different households (WEHNER 2011). In 1983 contracts for land leasing were assigned to the households. Initially they were contracted for 15 years. The first extension of these contracts occurred in 1998, with the latest extension in 2008 enabling the land owners to increase their lease for a period of 30 years, and particular a 50-year increase for forested land (WEHNER 2011).

There are several laws that regulate property rights of land and tenure in China. According to WEHNER (2011) the most important regulations are:

- General Principles of Civil Law of China (NPC 1986);
- Land Administration Law (NPC 2004);
- Law of the People's Republic of China on Land Contract In Rural Areas (NPC 2002).

Besides regulating property of land and administration, these laws intend to organize the protection of farmland (WEHNER 2011).

5.3 History of Rubber cultivation in the region of Xishuangbanna

The rubber boom in China started in the 1950s. When the Korean War ended, natural rubber imports were inhibited by the United States' trade embargo (CHAPMAN 1991). The opening up of China's industry towards market orientation had a distinct effect on natural resources in Xishuangbanna. Forestland, shrub land and plantations are current types of land use in the region of which rubber cultivation has the most significant impacts on the regional economy.

In Xishuangbanna, industrial rubber cultivation started around 1980. The core area of rubber cultivation can be found around Xishuangbanna's capital Jinghong. Traditional self-sufficient agriculture, livestock keeping and shifting cultivation were still practiced by minorities in the mountainous regions by that time (ZHAO-LU 2006). But under the local and national goal of economic growth, the landscape has rapidly changed from high diverse forests and complex agriculture into monoculture of tea and rubber cultivation (STURGEON 2012).

Between the 1960s and 1990s, approximately 50 million rubber trees have been planted in the whole of Yunnan province (CHAPMAN 1991). Chapman (1991) argues that the success of the intensive cultivation of *hevea brasiliensis*, in a region less suitable for rubber, can be traced back to the work and skills of the Bureau of State Farm Management in Kunming and, at national level, to China's policy to enhance domestic production rather than depend on imports. Rubber cultivation was not very successful in the beginning due to a lack of skills and forest dieback. This is why the Bureau of State Farm Management implemented a strategic

plan to minimize these losses (CHAPMAN 1991). In the 1960's and 1970's, state farms were established around the city of Jinghong. These state farms were enormous in size and were technically well developed compared to rubber farms in the neighboring countries Laos or Myanmar.

Picture 11: Rubber tree in Kemu village



Due to the HRS, there was a shift from state farms towards rubber cultivation on family owned farms. This trend became most visible around 1985 when smallholder plantings spread enormously throughout China (CHAPMAN 1991). The livelihoods of local farmers started to improve as a consequence of improvements to their cultivation system. In addition, other stakeholders, like local governments further encouraged the farmers to try planting new species and using new technologies (TANG 2013). The average income in Xishuangbanna thus has increased around ten times between 1988 and 2003 (AHLHEIM et al. 2012). The yearly average profit of one mu of rubber amounts from 2,000 to 5,000 RMB. In comparison, the net benefit of hybrid rice is 700 RMB per mu (TANG 2013). The promotion of other agri-

cultural products like fruit trees and other cash rain-fed crops failed due to several reasons, of which investments and high technologies were a limiting factor, and market access and profitability favored rubber as a main income source (TANG 2013).

5.4 Land Use in the NRWNNR

5.4.1 Historical Overview of Land Use

As previously mentioned, the study location is the Naban River Watershed National Nature Reserve. This reserve was established in 1991, stretches over two counties, Jinghong and Menghai, and belongs to two townships: Gaza for Jinghong and Mengsong for Menghai (WEHNER 2011). The nature reserve is managed under the philosophy of the Man and Biosphere Network, which aims to “... *facilitate the co-existence of humans and the environment*” (WEHNER 2011: p. 44).

The network was initiated by the UNESCO and launched in the early 1970's. The division of the nature reserve into three zones (Core, experimental and buffer zones) aims to achieve a balance of human and nature living together. The core zone comprises the areas with the best-obtained primary forests contained within the nature reserve as it is protected from any destructive activities (WEHNER 2010). Depending on the geographical location the buffer and experimental zones contain different agricultural activities: rubber cultivation or other crops (WEHNER 2010). “*The forest areas of the lowland zones in NRWNNR have [...] experienced the most fundamental, multidimensional change: from a multi-purpose, spiritual, economic landscape to a commoditized, mono-structured, single purpose space*” (WEHNER 2011: p. 115).

The most important types of land use in the NRWNNR region are secondary forests, rubber and bamboo plantations, shifting land (wasteland), irrigated land and tea. But the limited and declining area of collective forest, accompanied by the growing population, have led to an over-exploitation and degradation of forests, resulting in an increasing loss of traditions. Hunting was traditionally practiced until it was legally forbidden in 1999 (WEHNER 2011). Since the introduction of rubber trees in the beginning of the 1980's, it has become the major crop and source of income for many farming households in the reserve area.

Within the buffer- and experimental zones of the NRWNNR, any type of agricultural production is allowed and done by the inhabitants of the villages as well as by outsiders who invest in the region. The majority of the population living in the nature reserve was involved in paddy rice cultivation, collecting wild plants, bamboo shoots, mushrooms, upland rice and corn cultivation (ZHAO-LU 2006). Agricultural production was highly influenced by the affiliation to different ethnicities that were settled in that area, “... *with the Dai as rice farmers, the Lahu as shifting cultivators and hunters and gatherers and the Akha and other groups as practitioners of both, shifting cultivation and paddy rice cultivation*” (WEHNER 2010: p. 46).

Most villagers reported that corn, rice, tea and other vegetables for self-subsistence were the main agricultural products. Indigenous knowledge about how to grow the different crops played an important role for farmers. The natural forest was a source for collecting firewood and wild herbs. There was no cultivation procedure or forest management in the past (TANG 2013). Shifting cultivation was a common procedure before the implementation of rubber into the NRWNNR. Due to this, the landscape was able to recover naturally from the cultiva-

tion period, “... *but with the introduction of rubber, rotation land was transformed into plantation land*” (TANG 2013: p. 87).

Rubber Cultivation

The earliest state rubber farms in the region around Jinghong were established in the late 1960s and 1970s (CHAPMAN 1991). It was the result from an increased price for rubber on the world market to meet the high demand for rubber on the national and international market (LI et al. 2006). Most of the farmers that were interviewed explained that they had started growing rubber because they observed the state farms’ success and due to this rubber plantations started to expand in the NRWNNR. Furthermore farmers explained that they received support by state farms as a further incentive to change from crop production to rubber cultivation. Pabin was one of the first villages to start rubber cultivation as a monoculture. One reason for the early adoption was its close proximity to the state rubber farm (WEHNER 2010).

Picture 12: Landscape dominated by rubber tree plantations



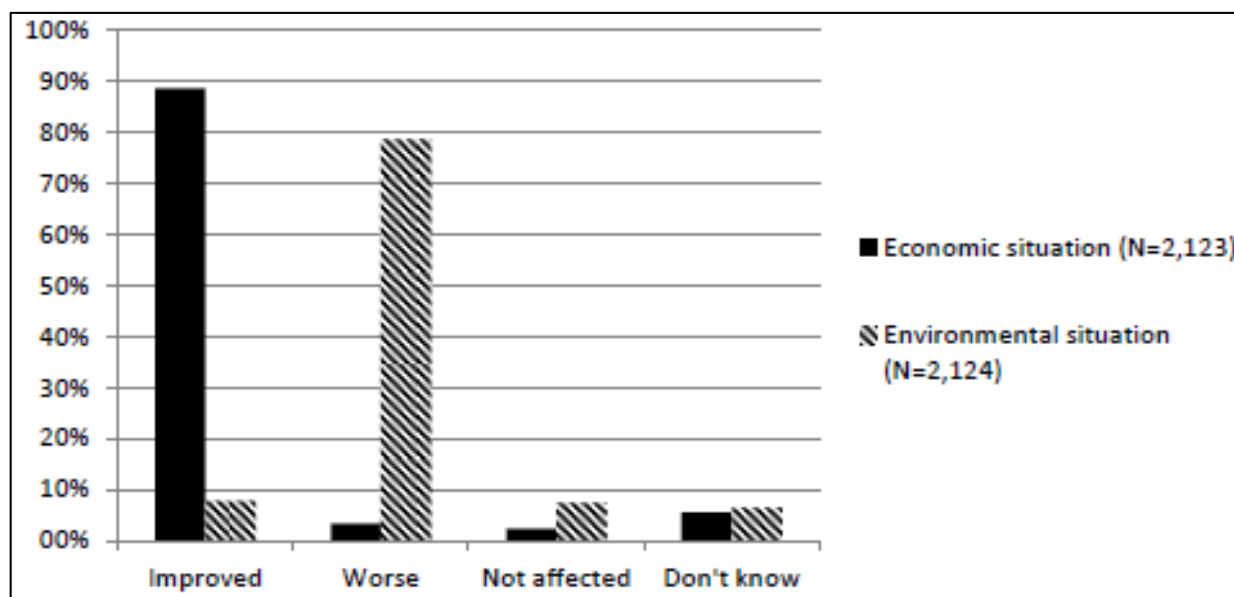
Rubber production promises higher incomes than any other cash crop in the region. A farmer from ZhongZhiChang, who is also one of the pioneers among the rubber farmers in the village, stated that her daily profit rose about 200 times since 1989. According to her, the daily profit of a rubber tree was about 0.10 RMB back in 1989 ($0.10 \text{ RMB} \times 1000 \text{ rubber trees} = 100 \text{ RMB/day}$). Today, the farmers in ZhongZhiChang achieve a profit of 60 to 80 RMB per tree per year depending on the market price for natural rubber. Even if those numbers are subjective estimations, they show to which extent the stakeholders positively perceive their individual economic growth. Asked why they have started to cultivate rubber most of the re-

spondents named “higher profits”. The village head in BanQianDi said: “*I saw them (XiaonuoYou Village) become wealthier and I also wanted to be like one of them. That’s why I’ve started to grow rubber to increase my income [...]. To me, rubber is a way out of poverty*”.

A farmer from BanQianDi who just started to plant rubber five years ago said: “*If you want to have a better life, you have to follow what other villagers do. If you have a lot of land you should plant rubber on it. Other villagers already live a better life, you could also have this life.*”

A survey conducted by the Center for Research on Innovation and Services (FZID) at the University of Hohenheim confirms the findings from the present study. When asked about their economic situation, 90% of interviewees gave a positive response (Figure 13). At the same time, almost 80% of the respondents agreed that the environmental situation has gotten worse.

Figure 13: Respondent's perceptions of the effects of rubber cultivation on their economic and environmental situation



Source: AHLHEIM et al. 2012: p. 12

The prefecture accounts for 35% of the national total rubber production, which is reflected in a share of 30% of the total GDP of Xishuangbanna. Apart from the tourism sector, rubber has been one of the main drivers for the local economic growth and continues to do so (AHLHEIM et al. 2012).

5.4.2 Land Use Regulations

The NRWNNR administration is subject to the Nature Reserve Law of China of 1994 (WEHNER 2011), i.e. implementing new policies concerning nature protection must always be consistent with the law. Splitting up the nature reserve into different zones is one such concept of the Nature Reserve Law.

The major tasks of the NRWNNR administration are forest conservation management and scientific research, i.e. biological, ecological and social developments within the NRWNNR (NRWNNR official). Due to the community co-management approach, the communities themselves are able to participate in the decision-making process concerning management issues (WEHNER 2011). International organizations such as the German Gesellschaft für internationale Zusammenarbeit (GIZ) or the Asian Development Bank (ADB) are also influencing the work of the NRWNNR administration office (NRWNNR official; WEHNER 2011).

When the NRWNNR was established in 1992, the administrative office sought out for native people to work for them. Initially the primary task of the NRWNNR authorities was to inhibit the cutting down of natural forest (NRWNNR official). This policy led to conflicts because regulations to protect the natural forest competed with the expansion of further rubber plantations. In order to prevent farmers from destroying natural forest, forest rangers were enlisted and were responsible for controlling the adherence of the people to the NRWNNR regulations (forest ranger). Furthermore the aim of the forest ranger is to educate the villagers on how to protect the natural forest and how to prevent fires. In the case that regulations are impinged upon punishments can be imposed.

Due to the government expanding power over the NRWNNR's area, some village re-settlements were implemented within the nature reserve. One reason for relocation of some villages was for a better organization due to increased accessibility to the village itself (WEHNER 2011). Another reason was the implementation of the different zones, which intends to secure the region's natural forest. Three different zones were defined in regard to the region's river system (NRWNNR official). Farmers were no longer allowed to cut down more natural forest for further rubber cultivation. Additionally, above an altitude of 1100m rubber cultivation is prohibited.

Within the core zone of the NRWNNR, no agricultural production is allowed. Due to the formation of different zones some villages had to be relocated. For example, the village of Pabin was originally located in the built up core zone and because no human activity is allowed in the core zone the inhabitants had to move.

5.4.3 Property rights

The HRS reform was fully initiated in 1982 in the NRWNNR. Only farmers who legally had registered their place of residence within the NRWNNR had the right to own land in their villages (TANG 2013). Yet, the government hasn't been able to accurately document the actual amount of land owned by each farmer in the NRWNNR. The reason for this is that there is no standard of how the cultivation of rotational land is organized (NRWNNR official). For example, in case of a conflict concerning ownership, the village head of ChaChang would ask the village elder for help since they know to whom the land belongs. Nevertheless, "*... land previously owned by the people under the institutional arrangements of the People's Communes attained the status of collectively owned land*" (Wehner 2011: p. 92). This collective land is governed and regulated by administrative village agencies (Wehner 2011).

The state land, which includes land from either state rubber farms or state forest is owned by the state and regulated by its institutions. Inhabitants of ManDian village complained that rubber forests are not always clearly defined and because of that property disputes occur.

After the legalization of the Land Transfer Rights Agreement, land transfer and land leasing activities increased rapidly (TANG 2013). This can be explained by the profitability for farmers to lease land to investors from outside the NRWNNR. For many farmers it is more profitable to lease their land than cultivating it by themselves either because of the expenditure of human labor or because of lacking investment possibilities.

5.4.4 Consequences of NRWNNR Regulations on Rubber cultivation

There is no consensus concerning restrictions imposed by the NRWNNR. Some farmers were aware of the necessity to protect the natural forest and other farmers complained about not being able to expand their rubber cultivation.

In villages that are close to the core zone, like ChaChang or Pabin, the inhabitants were clearly aware of the benefits that come from the primary forest. Furthermore, they compared their livelihood with that of other villages and came to the conclusion that due to better air quality and access to water resources there were fewer complaints in their villages. Many respondents said that the air quality has decreased enormously in the last decade, due to intensive use of chemicals in the rubber production. Their ancestors still experienced natural forests full of biodiversity and their natural services but today water scarcity seems to become a serious problem and some rubber farmers clearly see a link between this and increasing rubber plantations.

On the other hand, rubber cultivation is still seen as the catalyst to the increasing wealth among farmers. In addition, the cultivation methods are less elaborate than other crops such as paddy rice or maize, which, in their opinion, leads to an improved quality of life.

So far the NRWNNR has no power to prevent outsiders to come into the nature reserve and make use of the land and natural resources. Again, there are different opinions on that. Some village heads see outsiders as a benefit since they invest in the region and disseminate new knowledge and skills. The NRWNNR has a more critical opinion on that because often outsiders build up intensive rubber or banana plantations and therefore contribute to the increasing pollution.

5.5 Rubber cultivation in the villages within the NRWNNR

When the HRS was introduced in the NRWNNR in 1982, a dramatic socio-economic transformation took place. Local farmers started to improve their livelihoods by cultivating new cash crops, which were introduced by the government (TANG 2013). Besides hybrid paddy rice, rubber was by far the most profitable and successful one. Since rubber cultivation started to boom in the region of Xishuangbanna in the 1980's part of this research was to identify the beginning of market oriented rubber cultivation in the nature reserve of the NRWNNR.

Table 4 lists the information gathered from interviews conducted in different villages. It shows that most villages have started to grow rubber shortly after the establishment of the state farms in that region.

Table 4: Overview of rubber cultivation in the villages

	Kemu	Cha Chang	Naban	ManDian	Pabin	Zhong-ZhiChang	BanQian Di	Huilao
Average beginning of rubber cultivation	1996	1997	1993	1988	1986	1997	2007	2001
Early adopters	1984	1987	1986	1985	1985	1989	2005	1993
Late adopters	1998	2005	1998	1995	1996	2005	2008	2007
Rubber plantation (mu)	2420	735	780	2098	1070	1322	150	1038
Percentage of tapped rubber	100			100	80	75	10	20

One can see that villages like BanQianDi and Huilao, started growing rubber trees relatively late. The reason for BanQianDi's late development is that this village which belongs to the Menghai County has only been in existence since 2003. The people living in BanQianDi are currently considered to belong to the Lahu minority. Since they formerly had limited access to road connections and additionally, part of the forest they had been cultivating is a hotspot of biodiversity, the government forced them to move to BanQianDi. In the following chapters, the development of rubber cultivation within the sample villages is presented.

5.5.1 Kemu

Before 1984, villagers in Kemu used their land for upland rice and corn. Villagers soon recognized that rubber development in Kemu could change their livelihood and lifestyle. In 1996-1998, the government provided subsidies of 20 RMB/mu for developing family-owned rubber plantations, with technical assistance from the state-owned farm such as grafting rubber trees, tapping, processing and training as a condition of the agricultural conversion scheme.

Rubber expansion in Kemu is highly influenced by government intervention in the village in 1984. Under rubber development project, farmers received credit funds from Rural Cooperative Credit to fund their rubber plantations. Farmers signed loan contracts with Rural Cooperative Credit under their land certificate (Village head). Some villagers were slow to adopt rubber regardless of the subsidy given by government for several reasons, uncertainty over food self-sufficiency, ownership, and limited market outlets for selling latex and non-attractive latex price during price fluctuations (Village head).

Although, rubber plantation will generate income only in 7-8 years after planting, villagers did not mind waiting to harvest them as they recognized that rubber provides larger incomes

compared to other crops such as rice and corn. Most rubber plantation farmers became better off. Their livelihoods were getting better from the rubber production in their village, including electricity, water supply and infrastructure. During non-attractive latex price such as in year 2012, farmers were reluctant to sell their latex and store them in solid forms until the price stabilized in the market.

5.5.2 ChaChang

Agricultural activity is mainly focused on rubber cultivation. In fact, ChaChang's economy is mono-structured with rubber the only cash crop.

Before 1992, villagers in ChaChang used their land for banana, corn and tea cultivation. Tea was a major crop in the village during that time. The majority of the families owned agricultural lands, knowledge and skills came from their fathers or grandfathers. During the late 1990s, conditions in the area became suitable for rubber plantation and by 1997, rubber plantations were established in ChaChang. Government provided subsidies and credit funds to smallholder farmers at the start. For example, farmers only need to pay 5 RMB per grafted tree (real cost 8 RMB). As a condition of the agricultural conversion scheme, the government also provided the villagers with technical support on rubber planting techniques, skills and training from state-farms. The main road was paved by the government in 2012.

With a higher latex price, the area of rubber plantations in ChaChang increased to 2 000 mu (29 families) in 2013. More farmers realized that rubber provides larger incomes compared to other crops such as rice, soybean, corn, and medicinal plants. In fact, most rubber plantation farmers are better off today. During times of non-attractive latex price, farmers store latex in solid form until the price stabilizes.

5.5.3 Huilao

It is essential to recognize that every family in Huilao converts their croplands into rubber plantations on their own initiative after seeing the success of state-owned rubber plantations. Families did not receive subsidies from government although they planted rubber in their cropland. Still, farmers involved in this rubber plantation were provided technical support on rubber planting and tapping techniques by government through the state farm workers. In 2003, price for grafted rubber trees was relatively low compared to the current market price in Jinghong. In 2003, one grafted tree cost around 1.8 RMB while in 2013, it cost from 15 RMB to 20 RMB.

Rubber plantation will generate income only after 7-8 years of planting. Almost all farmers have husbandry for self-consumption. Lack of support services to farmers in terms of technical, credit, inputs, processing could have an adverse impact on rubber plantation management and future yields of latex in Huilao.

Picture 13: View from Huilao



5.5.4 BanQianDi

The villagers of BanQianDi have inhabited the forest area, practicing slash and burn agriculture for generations before their resettlement by the government in 2003.

In 2013, total agricultural land in BanQianDi amounted to 400 mu with 150 mu planted with rubber trees. Eight out of the ten households in BanQianDi have their land planted with rubber trees since 2007 but most their young rubber plantations are not yet productive. Only one household in BanQianDi has started to tap his rubber trees. In 2011, some villagers received rubber tapping training offered by Agricultural Department in DaNuoYou. Besides that, farmers learned the technique of land preparation and rubber seedlings from nearby villages such as XiaoNuoYou and DaNuoYou. Grafted rubber trees could be bought from the market in Jinghong at prices ranging from of 15 to 20 RMB in 2013.

It is important to note that the majority of households in BanQianDi have decided by themselves to convert further cropland into rubber plantations in future to improve their living standards.

5.5.5 ManDian

In 1986, rubber plantations were established in ManDian as government provided 0% interest loans to smallholder farmers to start rubber cultivation (village head). As a condition of the agricultural conversion scheme, the government also provided the villagers with technical

support on rubber planting techniques, skills and training from state-farms. ManDian's economy is mono-structured as rubber is their only cash crop.

Every family in ManDian had planned by themselves to convert their croplands into rubber plantations after they saw the success from state-owned rubber plantation. The seedlings were bought from neighboring village, state farms, and the market in Jinghong at different prices. Livelihood has improved from rubber production in their village, including electricity, water supply, health service, housing settlements and paved roads.

The landscape of this traditional rice growing village was changed by an influential farmer. He started to cultivate rubber on his land in 1985. But in 1987, he went to work on a state farm to learn how to grow and tap rubber. Upon the return to his village, he decided to convert his croplands into rubber tree plantation to lift his family out of poverty. He started tapping in 1993 and now owns 94 mu of rubber. His success raised the interest of other villagers to learn how to grow and tap rubber under his guidance. Rubber adoption in the village has improved the income of households but caused a decline in the tea and rice production.

The survey also provided information on hired workers of the ManDian rubber plantation. The hired workers interviewed mentioned no problems with their employers. In fact, they strongly declared that they were happy with their jobs and their livelihood was improving as a result of the support from the employers who were outsiders renting the land from one of the villagers in ManDian. Services include free electricity use, water supply, tapping tools, transportation, agro-chemical and housing settlement. Income from selling latex is divided between employer (67%) and the hired worker (33%).

5.5.6 Pabin

In Pabin, villagers used their land for corn and tea cultivation before 1986. In 1997, some of the farmers received extension advice on rubber tapping techniques from government. Moreover, village authorities also assisted those rubber farmers with rubber tree disease control in the village. Besides that, farmers learned the technique of land preparation and rubber seedlings from the state farm.

All rubber farmers stated that rubber provides higher profits compared to other crops such as rice and corn and that this is the main reason why they converted more of their paddy field to rubber plantations. Some have not started to tap their rubber trees as their rubber trees as they are still young. Other than that, rubber planting requires less compared to rice production. They presently do not fear about food insecurity as they felt that income generated from rubber productions are able to provide them with everything they need.

Every family in Pabin had planned by themselves to convert their croplands into rubber plantations after they saw the success from state-owned rubber plantation. Their livelihood has been improving from the rubber production in their village, including electricity, water supply, housing settlements and paved roads.

Picture 14: Pabin



5.5.7 Naban

Before 1986, villagers only planted corn, bamboo and tea. They depended on collection of forest products and upland rice cultivation. Presently, they have a limited number of paddy rice fields as most of their rice fields have been converted to either banana or rubber plantations. In 1986, rubber plantations were established in Naban when the government provided free rubber seedlings for one mu of land to smallholder farmers (Leader of women group). As part of the agricultural conversion scheme, the government also provided villagers with technical support on rubber planting techniques, skills and training from state-farms.

For several reasons, some villagers were slow to adopt rubber regardless of the subsidy given by the government: altitude of village, temperature, uncertainty over food self-sufficiency, ownership, and limited market outlets for selling latex and non-attractive latex price (Leader of women group).

Still, rubber farmers recognized that rubber provides higher profits compared to other crops such as rice and corn. This is the main reason why they converted more of their paddy field to rubber plantations. The seedlings can be bought directly from the state farm or the market in Jinghong. Presently, they do no longer fear food insecurity believing that income generated from rubber production is able to provide them with everything they need. Over the years, most rubber plantation farmers became better off. Some villagers also highlight the long life

of rubber trees as an opportunity for their children to inherit these productive assets. Their livelihoods improved as a result of rubber production in their village, including electricity, water supply, housing settlements and paved roads. The main road to the village was paved in 2011.

5.5.8 ZhongZhiChang

ZhongZhiChang, one of the poorest villages within NRWNNR was the first to grow rubber in 1989 under a credit scheme provided by government. In 1989, rubber plantations were established in ZhongZhiChang as government provided credit funds to smallholder farmers to start rubber cultivation. The credits are used by the farmers to buy grafted trees but they have to return the credit on the following year (1990, rubber farmer). As a condition of the agricultural conversion scheme, the government also provided the villagers with technical support on rubber planting techniques, skills and training from state-farms. Villagers started to expand their cropland in 1997 and convert their paddy and corn fields to rubber plantations. Some villagers have more than 100mu of rubber plantations. The head of the village for example owns 700mu of rubber plantations.

All farmers recognized that rubber provides higher profits compared to other crops such as rice and corn. This is the main reason they converted more of their croplands to rubber plantations. Rubber adoption in the village has improved the income of households but caused decline in the tea and rice production.

It is essential to recognize that every family in ZhongZhiChang had planned by themselves to convert their croplands into rubber plantations after they see the success from state-owned rubber plantation and neighboring rubber village. They bought the grafted rubber trees from Jinghong market to plant on their land. In 1989, one grafted tree cost 1.5 RMB while in 1997 the price had risen to 5.5 RMB per grafted tree. Some villagers also highlight the long life of rubber trees as an opportunity for their children to inherit these productive assets in future. Their livelihoods improved from rubber production in their village, including electricity, water supply, housing settlements and paved roads. The road leading to the village was in 2010.

5.6 Income Alternatives to Rubber in the NRWNNR

The region's tropical climate and favorable location near the Mekong and its tributaries allow for rural production of many types. Livestock, annual, and perennial agriculture are possible and have been practiced throughout history (TANG 2013: p. 79-85). It was observed during our stay that almost every meal in the villages contained food that was picked from the nearby fields. For example, in Kemu, there was freshwater seafood fished from the river adjacent to the village in 2 meals a day. Food sources ranged from a lemon tree in the front yard, a cabbage patch nearby, family sustenance livestock, and harvested inflorescence of many trees. The food was of a variety that could be compared to the finest international menu imported from around the world with products from less than 50 kilometers away. The region is very famous for tea and tobacco as well. This is just a testament to the versatility and access to production that rural inhabitants may have in the villages.

5.6.1 Definition of terms

By a simple definition an alternative is “*available as another possibility or choice*” (OXFORD DICTIONARY), but that is too broad when considering all of the options available to tropical climates. Possible alternatives in the NRWNNR are endless but many are not economically viable and could not support a household in place of rubber cultivation. The definition chosen for this research was to focus on rubber and to find alternatives that may be able to supplement or even replace rubber as an income source for families. Thus, alternatives, in this case, would need to be viable biologically as well as being considered competitive or supplemental with rubber production.

5.6.2 Alternatives in the NRWNNR

TANG Lixia (2013) has gathered information on previously implemented programs by the NRWNNR and partner organizations for past implementation of alternatives in the village. This combined with one of our interviews with an NRWNNR official gives us sufficient information to conclude that one will not find many economically viable alternatives in the area that are not listed by her or implemented in conjunction with the NRWNNR (NRWNNR official).

In the interview with the NRWNNR official it became clear that the crops being harvested were introduced by an internal program in association with other groups. Rubber had been introduced by various governmental and private organizations over a long period of time but the alternative crops or livestock were being introduced as a program of the NRWNNR. One of the main goals of this research was to identify how, when, and who disseminated knowledge about all aspects of life for the villagers and in an overwhelming number of interviews we found that the official’s account about the spread of knowledge on alternatives was correct. Villagers learned of these alternative programs via governmental organizations, which were not always identified by name but were associated in some level to the NRWNNR.

5.6.3 Field research findings

As previously discussed, the vast majority of income across the Jinghong side of the NRWNNR was in natural latex production (NRWNNR official). Not all of these possible alternatives in the NRWNNR were competitive with rubber for some reason or other. This section will try to properly paint a picture of past, current, and future income alternatives to rubber as portrayed by the villagers.

Tables 5 and 6 are a compilation of the data gained from the interviews. There are three categories of participation in alternatives for income. Table 5 is a check mark for current production and sale or developing the product for sale. The second is a diamond for future plans to produce an alternative and finally the last symbol, P, is for past endeavors that failed for a multitude of reasons. Even though tea draws a much smaller income amount than rubber we decided to include it since they were still choosing to grow it even when they could replace it with rubber in many cases. Finally, there occasionally may be two markers in a single box. For example, a P and a ♦ would signify that they have a future interest in the alternative but they have previously failed in the past in this endeavor. These graphs are limited in scope by

the questions we asked, the villagers we had access to, translation errors, and potential psychological issues associated with answer questions to foreign researchers. But even with these hindrances the response to our presence in the NRWNNR and the willingness of people to help us with our research gives confidence that they have answered to the best of their knowledge.

Table 5: Agricultural alternatives to rubber in the villages

Villages	Livestock	Tea	Nut Trees	Grafting	Intercropping with rubber	Den-drobe	Cash crops	Ba-nana
ManDian	√				◆	√	√◆	
Naban	√			√				√
Pabin	√			√				
Kemu	◆ P				◆	√		
Huilao		√					√	
ChaChang								√
BanQianDi		√		◆	√		√	
ZhongZhi Chang	√	√	√					

Table 6: Non-Agricultural alternatives to rubber in the villages

Villages	Restaurants/shops	Non-farm part-time work	Renting out land	Tourism
ManDian	√	√	√	◆ P
Naban	√	√	√	
Pabin	√	√	√	
Kemu		√		
Huilao	√	√	√	
ChaChang	√	√	√	
BanQianDi		√		◆
ZhongZhiChang				

Table 7 is a valuable indicator of past and present agricultural alternatives programs. There are a few trends worth noting from this chart for the purpose of this analysis. The promoting agents for a very large portion of these programs had some sort of governmental organization and the adoption status of these and the large proportion of programs for forestry land. This may be an indicator of where these promoting agents' interests are. Most of the paddy land crops will not create as much revenue as the rotational or forest land crops.

Table 7: New plants introduced to the NRWNNR

Plants	Year	Promoting agent	Adoption status	Main reason
Paddy Land				
Hybrid paddy rice	1986	Local formal agricultural extension system	Dominant agricultural crop	High yield
Capsicum	2002	Outside Businessmen	Failure	No market
Bean	2006	Local Institute of Tropical Crops	Failure	Not suitable to local natural conditions; market
Watermelon	2002	Ag. Technology station, outside businessmen	Planted only by some land lessees but not local farmers	
Winter Melon	2006	Agricultural Science Institute	Failure	Complex Technology, costly and no market
Autumn Maize	2001	Neighboring Villages	Secondary Crop	Simple Technology
Rotation land and forest land				
Rubber	1984	Jinghong plantation farm	Dominant forest plant	
Amomum	1984-1992	Pharmaceutical company	Initially successful but replaced by rubber	Comparatively lower profit than rubber
Sappanwood	1984-1992	Pharmaceutical company		
Orange	1996-1997	NRWNNR office, Bureau of Science and Technology	Failure and let them along	Difficult to manage, high technology requirements, low yields and poor quality, no market
Grapefruit	1996-1997	NRWNNR office, Bureau of Science and Technology		
Lychee	1996-1997	NRWNNR office, Bureau of Science and Technology	Failure, replaced by rubber	Complicated management, high technology requirements, low yields and poor quality, no market
Longan	1996-1997	NRWNNR office, Bureau of Science and Technology		
Walnut	1996-1997	NRWNNR office, Bureau of Science and Technology	Now Dual-cropped with tea in Xiaonuoyoushangzhai	Uncertain
Lemon	2001	NRWNNR office	Failure, replaced by rubber	No market
Bamboo	2005	Local Government and	Some farmers grow near	High costly

Plants	Year	Promoting agent	Adoption status	Main reason
		company	contracting land planted by company	transportation
Winter Yunnan Hemp	2006	Former agricultural extension system	Failure	Not suitable for local natural conditions
Medicine Orchid	2007	NRWNNR office	Still in pilot test phase	Costly investment
Summer Hemp	2008	Formal agricultural extension system	Promising new high-altitude cash crop	High profit, driven by government

Source: TANG 2013: pp. 79-80

From these graphs and our data we have found a few important trends in alternatives for income in the NRWNNR. Renting arable land and forestry land is a reasonable source of income for many villagers across many villages in the NRWNNR. Non-farm work is also a very large income producer for many of the villagers in the NRWNNR. Another important trend was the interest in alternatives in general. We will go over all of these findings as well as a few localized cases in the following sections.

5.6.4 Localized Cases of Alternatives for Income

Specialized conditions that were found are the Yam production in Huilao, Peacocks in Kemu, and the cooperative effort of BanQianDi.

Yam production in Huilao is an important case. According to the respondents, it was initiated and implemented privately. The leader of the women group of Huilao reported that the seeds and technical information was provided to them for production from a business that produces alcohol from yams. The prices are guaranteed every year and farmers do not need other inputs such as fertilizer or pesticides. This is an interesting case because most of the alternative projects in the NRWNNR were introduced via an outside organization in conjunction with the NRWNNR. With the limited scope of our interviews we are unable to confirm whether it was an entirely private effort. Table 7 shows that most efforts are dominated by the NRWNNR or another level of government. With further research into ventures like this possible implementation of new programs could produce similar successful models.

The NRWNNR carried out a program in Kemu for raising peacock. The program funded free young peacocks to the farmers as well as care information. The program provided starter birds for 10 of 22 households (farmer). One family sold 6 of the peacocks for 120 RMB per kilogram and with each bird weighing 5-8 kg. The program finally failed because the NRWNNR only provided them with limited technical information. When the birds got a disease the villagers were unable to cope with the situation. The program ended as a failure but the farmer said they would try again as it seems to be very profitable if they could keep the birds healthy (Kemu farmer).

Picture 15: Dendrobe plantation in Kemu village



BanQianDi has a very ambitious cooperative initiative where farmers will “... cultivate and sell ecologically produced food plants like tea, bamboo shoots and mushrooms and also rubber. We also want to establish tourism, so we are planning to build a guest house here” (farmer in BanQianDi). Part of the plan is to use the cooperative to buy rubber from nearby villages and sell it directly to the factory at a better price. The organization was started by a villager with the help of some outsiders. Once the cooperative is fully functioning tourists will be invited to do eco-tourism in the region associated with the ecologically-friendly food production and the surrounding nature reserve. They have formed a business relationship with a villager from another village for consulting purposes and have established a relationship with the local government. Each person joining the cooperative is eligible to receive a 50,000 RMB loan interest free (Farmer BanQianDi).

Dendrobe

Dendrobe is considered as an alternative of investment for the farmers in some of the villages. As most of the new investments projects, it was brought by an outside organization in conjunction with the NRWNNR. This orchid species is used in Chinese traditional medicine and if grown properly the sale can be more profitable than rubber (Farmer Kemu).

The farmers of Kemu made it clear that dendrobe would be an accepted alternative if they would profit from it like they do with rubber. As explained by nearly all the interviewed farmers, it is the lack of necessary techniques and knowledge about the production of this species which hinders production. *“Kemu needs training and management skill in dendrobe or orchid flower, other plants can make more money than rubber”* (Forest Ranger). Dendrobe requires difficult cultivation management skills. It cannot be in direct sun nor can it be planted directly into the soil. Most farmers of Kemu described the initial failure as lack of knowledge but were interested in learning more with their current dendrobe cultivation. Dendrobe failed only when they had problems with the plants and they were unable to get into touch with extension advisers (Farmer).

Six out of nine respondents in Kemu expressed interest in replanting dendrobe and all considered the NRWNNR and its extension services in a very positive manner. They feel that they have learned a lot from the process and are interested in working with the NRWNNR on continuing dendrobe and possibly try other programs.

Land Rent

Many villagers are renting out land both for forestry and for arable land crops. Farmers provided us with many reasons as to why they rent out their land. A farmer in ManDian said: *“If you tap large amounts of rubber it is likely that you will not have time to cultivate rice or other arable land crops. [...] Another reason for renting is simply because there are regulations against planting rubber on arable lands.”*

Picture 16: Banana plantation



In table 8 specific reasons for renting are displayed, village by village with specific interview responses.

In the village of Naban, many villagers are renting out to a banana producer because they would make less money by growing rice on that land. Most of the interviewees in Naban are renting out their land through multiple different contractual schemes that differ in amount per mu and length of time. With much certainty we were able to conclude that in the small village of Kemu they were not renting out any land. Why one village or a specific villager rents out their land has a variety of reasons but most renting farmers have a very positive view of renting land.

Table 8: Reasons for renting land in different villages

Village	Observed situation	Reason for leasing/renting
ChaChang	The village head leases half of his land to a banana farmer who is from outside the NRWNNR	<ul style="list-style-type: none"> ➤ To learn from the outsider ➤ To increase income
Kemu	The village head doesn't know anyone from his village leasing land	<ul style="list-style-type: none"> ➤ At present there is no possibility to expand rubber forests due to NRWNNR restrictions
ManDian	<p>A rubber farmer leased part of her land to outsiders who wanted to cultivate beans, pepper and corn, however it failed due to lack of knowledge about local weather conditions and market mechanisms</p> <p>The villagers have leased almost all of their rice crops and arable land to outsiders</p>	<ul style="list-style-type: none"> ➤ more profitable to lease arable land than cultivate on her own ➤ tapping rubber is time consuming • • lease arable land so as to not depend on harvest
Zhong-ZhiChang	<p>A farmer rented 20 mu from another villager on a 50-years contract and paid 30,000 RMB in cash</p> <p>The village head of ZhongZhiChang rents 700 mu of land mostly situated in DaNouYou and Huilao/HuoNan; all land is not suitable for rubber cultivation, therefore he intercroops nuts and coffee</p>	<ul style="list-style-type: none"> ➤ Increase production ➤ unknown
Pabin	A farmer rents part of her land to outsiders from Menghai	<ul style="list-style-type: none"> ➤ not enough money to cultivate rubber trees on her own
Naban	A farmer rents part of his land to an outsider; there are inconsistencies concerning the duration and renting schemes; currently he gets 1,000 RMB/mu/year	<ul style="list-style-type: none"> ➤ important source of income

The benefits of renting out for farmers are free time to invest into rubber production, extra income that surpasses the amount of money they could make if they cultivate the land themselves, and a farmer in ManDian described it as a secure income source. If rubber prices dropped she felt that she would still get the money for renting out her land (Farmer). Negotiations for the rental contracts and prices paid are often mediated by the village head but the final decision in Man Dian is up to the family renting the land. In Naban, the banana farmer approached the village head as well but each of the contracts varied in their characteristics so it is likely that they were finalized privately as well.

Off farm work

Extra income from non-farm labor or from out of village employment was quite common. In the rubber off-season villagers would often go to a nearby city such as Jinghong and take work as a laborer. A farmer from Kemu said: “*My husband would work in the off-season of rubber in Jinghong doing construction work. He is often staying in Jinghong for a month straight and returning home for a couple days. When the rainy season begins he returns back to Kemu to harvest.*” While our research did not focus on this form of income many rural development studies based in Africa, and Latin America find that diversification into non-farm income is correlated with larger and more stable income (ISGUT 2004; TIMOTHY 2011; BARRET et. al. 2001).

Intercropping

Early in 2013, JuZiDi, BanQianDi, Pabin and ManDian were selected for the intercropping project introduced by NRWNR with collaboration with Xishuangbanna Tropical Botanical Garden (XTBG) and the China Academy of Sciences. 70 mu in JuZiDi, 60 mu lands in BanQianDi, 300 mu lands in Pabin and 40 mu lands in ManDian are used for this project. In this project, rubber is intercropped with medicinal herbs such as *Flemingiaphilippinensis* (Qianjinba 千斤拔), *Cortex cinnamoni* (Rougui 肉桂), *Rauvolfia verticillata* (Luofumu 萝芙木). The research was done by Xishuangbanna Tropical Botanical Garden (XTBG) and China Academy of Sciences over the past 10 years. Associate Prof. TANG Jianwei is in charge of this project. XTBG has made studies on rubber agroforestry, where rubber plays a major role and is associated with perennial crops.

The aim of this research is to diversify rubber agroforestry systems that have potential to improve the productivity and economic profitability as compared to the monoculture of rubber. Besides that, the systems of rubber intercropping with economic and medicinal plants can help maintain or restore biodiversity. A comparison community of rubber monoculture was established simultaneously. Observations were carried on the dynamics of plant growth, soil moisture, soil nutrients, and soil bulk density. There is a compensation of 40 RMB/mu/year for farmers whose lands are selected for this intercropping project.

Based on the research done by XTBG, *QianJinBa* is able to maintain soil moisture and improve soil nutrients in rubber plantations and extend the lifespan of rubber trees. Besides that, based on the research done by the China Academy of Sciences, rubber trees that are intercropped with *QianJinBa* mature 1-2 years earlier, and rubber trees could be tapped at the 6th year instead of at 8th year. Normal lifespan of rubber trees without intercropping with *QianJinBa* is 24 years whereas lifespan of rubber intercropped with *QianJinBa* is extended to

32 years. Apart from that, leaves of *QianJinBa* could be collected for fodder and also for human consumption.

Conclusion

Many alternatives for income programs have come to the NRWNNR and some remain while others failed. A recurring theme across all of our interviews was a very positive outlook on trying out alternatives. Most farmers would be willing to try these ideas as long as they are considered competitive with rubber. As some of these projects did not compete with rubber for land use and villagers saw them as profitable they showed serious interest.

Most of the knowledge dissemination about agriculture in the region is done through extension, the NRWNNR, and some private firms. Though many farmers thought that the extension services have been visiting less and less they still held a very positive opinion of these personnel. Implementation of these alternatives was seen as very positive even if they failed. The overall level of trust that villagers have of these knowledge dissemination services is quite high. Therefore, implementation of these alternatives is likely to have few problems if they can be portrayed as profitable to these farmers which is the main characteristic they were interested in.

6 Stakeholders and their role in rubber cultivation in NRWNNR villages

This chapter gives the purpose of the Stakeholder Analysis in this study. How to gain understanding about the key actors regarding rubber cultivation in villages within the NRWNNR, assessing their interest and influence in decision-making of more sustainable cultivation methods, new land-use concepts and conservation.

Four social actors were defined as key stakeholders with different levels of interest and influence in decision-making regarding rubber cultivation, namely: rubber farmers (with land ownership or leasing land), village heads, NRWNNR officials at the village level and hired workers.

Table 9 describes briefly the source of power of the four key stakeholder groups identified.

Table 9: Overview of Key Stakeholder groups

Stakeholder groups	Source of power
Rubber farmers	Land ownership or leased land, expertise, labor, social network
Village heads	Support by villagers; Connections with upper level authorities
NRWNNR Authorities	Government upper levels; Sometimes also confidence from farmers
Hired workers	Expertise in rubber cultivation; Sharing profits with the employer according to latex yield

As mentioned in chapter 2, one of the limitations of the stakeholder analysis is the treatment of stakeholder groups as a separate entity. This is the case e.g., when analyzing the village authorities who, besides their administrative position and leadership, are also rubber farmers.

6.1 Rubber farmers

Farmers are the key element in our stakeholder analysis as they are the driving force behind the entire rubber cultivation process. They are the players within a framework of rules and regulations. Key decisions about how to cultivate rubber and to what extent their practices influence the environment are made by these stakeholders. It is vital to know and understand the needs and problems of the farmer best, their thinking and how they perceive their possibilities within the selected framework.

Roger's *Diffusion of Innovation model* (2003) is being used to analyze our main stakeholders – the farmers. It is a useful model for an initial analysis as described in the theory introduced in chapter two. In this analysis five categories: *innovator*, *early adapters*, *early majority*, *late majority* and *laggards* (ROGERS 2003: p. 283) are being used to classify the interviewed farmers concerning their starting period of rubber cultivation.

1983 | The beginning of rubber cultivation

The *innovator* in our model is the first farmer among our respondents who had started cultivating rubber in Pabin in 1983. Today, he only cultivates rubber and some livestock. For an additional income source he grafts rubber seedlings and sells them to other farmers. Since his first training in 1997, he meets annually with an extension agent. During the years, he has changed his cutting techniques as well as the application of pesticides and his methods to control diseases. Like other farmers who have been cultivating rubber for a longer period he notes some environmental changes like water scarcity and reduction of animal species in this area.

1984-1985 | The next cultivators

The group of *early adapters* started cultivating between 1984 and 1985 and comprises of five farmers from three different villages (Pabin, ManDian, Kemu). In the model it is said that the early adapters are opinion leaders and have a high social status. They are the reason why an innovation is accepted and thus spread out. Consistent with the model, the innovator and the early adapters in our case are also mostly the farmers with the best skills and networks.

The group of *early adapters* are farmers in their mid-forties who have rubber-cultivating experiences up to 30 years. The land size varies between 10 to 93 mu and they only have rubber as cash crop. As most farmers received their first training by extension agents or state-rubber-farmers after the early 1990s, the beginning of rubber tapping was mostly a process of trial and error. Today they feel confident about their skills. However, many farmers have addressed the interest in further pest and disease management, as well as in alternative cultivating techniques, e.g. intercropping (several Farmers). Their main sources of information and help concerning rubber cultivation are state farms, relatives and neighbors. Some also state that they would call extension agents if they needed help. More experienced farmers also have a supportive function for those who have not been in the rubber business for long.

While the interviewed farmers of this group have never been to school, today all of their children attend or have finished school; some of them even receive higher education at college.

All of the *early adapters* agree on environmental changes during the last years (mainly water scarcity) and a rapid increase in overall wealth in the village due to rubber cultivation.

1986-1995 | The majority start cultivating

The group of the *early majority* consists of 14 farmers from all villages except BanQianDi who have started cultivating rubber in 1986. Since then, rubber has developed as their main cash crop. However, some of the farmers have recently started trying out new cash crops; for ex-

ample dendrobe (Farmers from Kemu), banana (Farmer from ChaChang), yam (several Farmers from Huilao) or nuts (Village Head of Huilao). Some of them say that the rubber prices are too unstable and it is not secure enough to rely only on rubber as an income source (Farmer). Additionally, some respondents thought about starting to intercrop rubber with chicken, bees or other crops. However, they mentioned concerns about the effects of pesticide use on intercropping projects (Farmer) during the interviews.

Some farmers are very knowledgeable about rubber production, for example a farmer from ManDian who has worked as a trainer for rubber cultivation. Others still talk about their lack of knowledge. Some state that they would like to know more about pest and disease control. The main sources of knowledge are relatives, neighbors or state farms (Farmer).

Two farmers of the *early majority* group have already hired workers to help them tapping trees. One farmer from ChaChang does not have enough support from his family and thus relies on the help of additional workers.

Almost all of the 14 farmers we have interviewed rented out land to farmers from other villages or to outsiders. Businesses of outsiders are generally welcomed by the farmers as they make business, which increases the overall wealth (Farmer). The size and duration of these contracts vary. There are no concerns regarding land use and soil degradation. While many of the early majority-farmers rent out land, only one of the farmers from ZhongZhiChang leases additional land. The farmers gave several reasons for not renting more land. The main reason is that the farmers wanted to make sure that they were making enough money for themselves. However, NRWNR-regulations and lack of labor resources were mentioned.

The perception concerning environmental changes varies. While some claim not to have noticed any environmental changes, others realize a decrease in water level and a rise in temperature (Farmers).

1996-2003 | More farmers begin to cultivate

The group of the *late majority* started cultivating rubber after 1996 and consists of 16 farmers from all villages except ChaChang. They are between 25 and 50 years old and own rubber fields of the size between 20 to 100mu. Among this group there are farmers who already went to school and have received some sort of education. The younger have mostly learned tapping rubber from their parents and now possess their own forests (Farmers).

Some of the *late majority* already do intercropping or try out new cash crops. However, they say that they have difficulties with new crops as they have only little knowledge. Additionally, they are not sure whether the alternatives will make decent profit (Farmer, Kemu). A farmer from Kemu reported problems with the dendrobe plant as there is neither enough knowledge nor a good supportive network available. This results in a reduction in yield and therefore, a loss in profit. All farmers in this group who tried to cultivate dendrobe have failed. They know about their lack of knowledge and would like to receive further trainings in order to successfully cultivate dendrobe. Many of the *late majority* discuss intercropping possibilities for the future but haven't experimented thus far (Village Head, Farmer).

2003 | The new generation of rubber farmers

After 2003, eight farmers from BanQianDi, Kemu, ZhongZhiChang, Naban, ChaChang and Huilao started cultivating rubber. In the model this group is called *laggards*, but in this paper they are henceforth referred to as the *latecomers*. In ROGERS' model it is said that they are usually not as socially accepted and are mainly poorer villagers (ROGERS, 2003). However, in our case we need to distinguish between two groups. Some of the interviewed farmers have just moved recently to the village. Others are the younger children of rubber farmers who adopted the profession of their parents and only recently started cultivating on their own. Both groups are accounted to the *latecomer* group. The younger villagers went to school, some even to college and they have learned how to cultivate rubber from their parents. They already have experiences with rubber as they grew up helping their family in cultivating and cutting.

In BanQianDi for example, rubber cultivation started as recently as 2000 and it is inferior in production area and harvesting techniques when compared to the other villages. Their land size varies from 4,5mu to 65mu and with an average of 30 mu. Farmers have less land available than the other groups. Although they are less experienced and may face pressures from outside of their village, this does not mean that they face pressures within their village community.

Picture 17: Rubber seedlings in Naban



Village newcomers especially have difficulties to integrate and thus have a poor network for help and support (ChenZhongYun, Huilao, XieYunHui, ZhongZhiChang). Most of the

farmers state that relatives or neighbors are very crucial when they need help with rubber cultivation (Village Head, Farmers). They don't have contact to the state farm and rarely to extensionists. While some have received training (Farmers; Village Head), others still undergo a process of trial and error (Farmer).

A farmer from BanQianDi, who has also just recently started cultivating, has never received training himself but shows others how to tap the trees. Additionally, two of the eight farmers mentioned that the work with rubber is much more stressful and they have less leisure time than before (Senior farmer; Village head).

Risk concerning rubber cultivation is mostly not perceived by the interviewees of the *latecomers* group. Instead, they are very optimistic about a good financial output.

Environmental changes are generally not observed and if so, they are not connected to the rubber cultivation (Farmers). Rubber is rather seen as a positive contributor to the environment.

Even though cultivation of rubber started in different years and thus experiences and income level varies, all farmers have one perception in common: enormously increased wealth. They all state that due to rubber, they can now afford to buy goods such as TV screens, cell phones, cars or motorcycles as well as to build better houses. Additionally, they do not need to work as hard anymore as compared to their former work of rice cultivation, resulting in more leisure-time.

While the perception of environmental changes as a result of rubber plantations varies, all the farmers we have asked do understand and obey the regulations by the NRWNNR concerning the forest protection. It is clear to most of them that with further deforestation the water quality will decrease which will be harmful for the villagers (Farmer).

6.2 Rubber farmers leasing land

Land renting has become very popular among the villagers in the NRWNNR (TANG 2010). Mainly outsiders, who have only recently moved to one of the villages, are leasing the land of the villagers. *"The land renters included the local officials, formal workers in local sectors, farmers in villages, neighboring villages and from outside of Jinghong county, workers in state-owned farms, businessmen and so on"* (TANG 2010: p. 1079).

The initial approach for business by an aspirant-lessee is to contact the village head and discuss price and general conditions of the land. After the negotiation, the village head calls the villagers to ask who is interested in renting out their land (Farmers, ManDian and Naban). Especially in Naban, almost all villagers have rented out parts from their land to one businessman from Guangdong Province.

Of the villages we have interviewed, only farmers from ManDian, ChaChang, Huilao and ZhongZhiChang are renting land. For instance, the amount of renters in ZhongZhiChang (ten villagers renting land outside) is very high compared to other villages like Huilao where only two of our interviewees, who were also outsiders, rent land.

None of the farmers from the other villages we have interviewed are leasing land themselves. Instead, many of them rent out arable land. One farmer stated that she would like to lease

land, but since it is very expensive it is no option she can take. The size of the leased land varies as well as the duration of the contract. However, “... *the duration of land renting is usually between 25 and 30 years, which matches the growth age of rubber and the legal duration of the land-use right*” (TANG 2010: p. 1079).

The reason why farmers rent out their land is to increase their short term income. While complaining about the low price they agreed to the lessee of the lowlands, all the people from Naban hope for the next contract round to increase the price per mu. Overall, outsiders are welcomed as they do business in the village and increase the wealth of the people.

In most cases the price for the land is given in a lump sum. One farmer said that he would only allow people he really knows and trusts, like relatives and old friends, to pay in installments. The lessee is given a free hand to do as he pleases with his leased property. This may be problematic: For example villagers from Huilao had not thought about the possibility of soil erosion when renting out. In ChaChang one farmer stated that if the lessee does not take care of the land properly he has to pay a fine.

Most of the lessees are poorer compared to other villagers, as they have moved to the village only recently and thus have just started their businesses (Farmer, Huilao). But there are others who had already a larger amount of land and got hold of additional land. In this case they are better off compared to the other villagers. WEHNER (2011: 59) states that “... *the villages with improved access have also become more appealing for external investors and businesses interested in land or agricultural and natural resource products. Thus, the widening gap in terms of accessibility could lead to further economic marginalization of the more remote settlements.*”

6.3 Village Heads

Village heads in the NRWNNR have been elected by the villagers since the late 1980's (WEHNER 2011). Besides being the administrative officials, they are regarded as opinion leaders and have the opportunity to access new information and knowledge. Consequently, village heads are prompted to invest in improved technology (TANG 2013) in order to enrich their cultivation systems and become wealthier (WEHNER 2011).

In all eight villages visited, the position of the village head was occupied by men. The only position engaged by women in the authority hierarchy at village level was the Director of Women's Council of Public Affairs. The range of age of the village heads is from 28 years old to approximately 50 years old. Only 2 out of the 6 interviewed village heads have had that authority title for less than 5 years, contrasting to the periods of 14-22 years in office that was observed in the rest of the villages.

A village head's main duty is to implement the rural policies and projects dictated by the Chinese Government at the village level (TANG 2013). In our interviews, village heads emphasized their efforts in improving public infrastructure such as roads. They are also the first contact for outsiders interested in renting land; indeed, official contracts are stamped by the village administration. In summary, a village head describes his duties as “... *leading villagers to a better life; help them to become richer, and work on public benefits such as roads to improve living and livelihoods*” (Village Head).

Picture 18: Huilao



A farmer also pointed out the role of the village head as a source for help when problems in cultivation have arisen; he states: *“In case of a problem we ask the village head to contact the extension service, as we do not know how to get in contact with them. It is usually the village head (...) who contact the dealers and extension officers. He is also reporting to the government.”*

Regarding rubber cultivation, village heads are usually asked not only to contact extension services, but also to provide advice by themselves because villagers acknowledge their expertise: *“I can ask for help from the village head, because he is more experienced and more skillful”* (Farmer).

Most of the village heads were early adopters of rubber cultivation, a fact that reinforces their leadership when other villagers followed them in shifting land-use to growing rubber: *“Initially the village head planted the biggest plots. The rest of the villagers started small and then continued to increase production over the next years”* (Farmer).

Village heads' opinions towards rubber cultivation are certainly positive. Due to the fact that most of them have been leaders for long periods they have seen the transformations in lifestyles and livelihood since rubber farming began. Although the majority of the interviewed village heads recognized that climate conditions are changing, becoming drier and water source scarcer because of rubber forests, some others do not consider rubber forest as the cause of such environmental alterations: *“I think that the changes in the environment have nothing to do with rubber cultivation (...); to me, rubber is a way out of poverty”* (Village head).

Village heads also have an important role in fostering initiatives for the improvement of rubber cultivation methods and marketing as well as a nature conservation objective. For example, one village head considers intercropping and animal husbandry in the rubber forest to be a possibility for future rubber development, but acknowledges that the village needs the gov-

ernment to provide proper knowledge in terms of the sort of crops and animals they could use with the rubber (Village head, Kemu). Furthermore, one of the interviewed village heads mentioned his intention to initiate cooperation among rubber farmers to get better prices. Although the first attempt failed due to lack of support, he plans to try it out again in the future.

6.4 NRWNNR Officials

There are 17 public extension institutions in Xishuangbanna. One of them is the NRWNNR Bureau which is a public administrative agricultural organization located in Jinghong¹.

The administrative bureau and its staff are the most important link between today's monoculture farming and a possibly better, sustainable rubber cultivation in the future. Their main objective is "... *to promote ecological balance and biodiversity in the NRWNNR*" (TANG 2013: p. 142), as well as the improvement of livelihood of the farmers. To achieve this goal they have set strict regulations where rubber is allowed to be cultivated. According to one official, this leads to disputes between farmers and the NRWNNR staff because the farmers want to further cut down primary forest in order to increase rubber cultivation. If farmers violate the rules, they can be punished with a fine between 100-500RMB or go to prison for one year depending on the level of violation. However, as many of them repeatedly to break the rules, one NRWNNR authority complains about these futile punishments. This is coherent with a statement of another NRWNNR official. However, she said that due to education and the friendliness of the NRWNNR officials, the villagers started to obey the policies (Farmer; NRWNNR official).

To increase the biodiversity and ensure the regeneration of the soil in the NRWNNR, the bureau has tried to introduce several intercropping-projects in the last years. However, their implementation has rarely been fruitful. As we talked to the farmers from Kemu only a few have been successful with cultivating dendrobe so far.

The biggest problem the administrators face is the consistently high price for rubber. Consequently farmers say that there is nothing else to cultivate that would be as profitable as rubber. Additionally, although they are aware of environmental changes, farmers feel that they do not have the knowledge and the foresight to change their cultivation practices. Today, it is still more important to them to make profit than to cultivate crops in a sustainable manner (NRWNNR Official).

The NRWNNR officials are not in the position to tell the farmers what they have to do, instead they can only offer suggestions and encourage them to cultivate alternative crops as well as to lessen the use pesticides and fertilizer (NRWNNR official). One official said that about 20% of the villagers are against the programs by the NRWNNR Bureau, but 80% of them would be willing to change. This goes in line with our research as we talked to the farmers, seeing that rethinking occurs gradually. While some of them are open to try out new

¹ As this section will not go deeper into the structure of the extension service institutions in Xishuangbanna, please read TANG Lixia 2013 chapter 6 "The External Dissemination System: Agricultural Extension" for further information. This paper will rather discuss the outcomes of the interviews with the NNNR officials and staff members and their influence on the farmer's behavior.

possibilities for cash crops, most recognize that they know too little in order to be successful. Farmers are still hopeful and very open towards the NRWNNR. They would like to take advantage of further possibilities, take part in trainings and exchange knowledge concerning crop alternatives. Nevertheless, all NRWNNR officials unanimously agree that large scale rubber cultivation poses an obstacle to the aims of the NRWNNR. Therefore, they do not offer any trainings themselves but seek other institutions to instruct farmers about cultivation.

Overall, this situation can be described as an unsolved conflict between the NRWNNR and the farmers. As the NRWNNR Bureau does not have a concrete solution of how to successfully change the current situation of rubber as a main income source as well as the mindset of the farmers, the villagers will continue to cultivate rubber and enhance the problems that come with the monoculture.

Another problem area for the NRWNNR staff are outsiders coming to buy the villagers' land (e.g. for banana plantation) or to promote new business possibilities (e.g. pig breeding) and their lack of environmental consciousness (Farmer). Most of them are said to take even less care than the villagers about the soil and biodiversity of the region (Farmer) and want to only to make profit. Trainings are neither obligatory for farmers nor for outsiders. This makes it even harder for the NRWNNR staff to change people's perspective on sustainability. Thus, NRWNNR officials do not recommend leasing land to outsiders.

Apart from their projects, the NRWNNR bureau has only a few other possibilities to influence the farmers' behavior. One official said that education is an important factor that influences the behavior and thinking of the villagers. To clarify the aims of the NRWNNR bureau, videos are shown to the villagers. Whereas the younger villagers like to watch videos about environmental protection, the older people rather like to hear about the extension service (NRWNNR official).

As the officials have many duties they cannot always be in the villages themselves, the other possibility is to appoint a villager as a forest ranger. Thus, they designate a person within villages to look after and protect the forest. The interviewed forest rangers understand the importance of their job and like what they are doing.

Overall, the NRWNNR intends to have good relations with the farmers visiting them on a regular basis and supporting them, but their main difficulty, i.e. how to change the farmers' perspective on environmental friendly farming, still remains.

6.5 Hired Workers

Rubber cultivation in the NRWNNR region is a labor intensive production system. Although the majority of the respondents said that all the activities involved in rubber cultivation were carried out by family labor, some rubber farmers interviewed owning a large number of rubber trees hire workers. As TANG et al. (2010: p. 1080) report most of the wage workers come from other villages, lacking land resources, or from outside the NRWNNR. Many of these hired workers come from other poor counties in Yunnan province, Hunan province and Huizhou Province.

Only two hired workers from outside the NRWNNR villages could be contacted for interviews in ManDian village. According to a female farmer in ManDian one-sixth of the house-

holds are hiring workers to work on their rubber plantations due to the lack of labor and a generally large land size. The hired laborers earn 30% of the profit from selling the latex and have contracts for one to two years. An important feature of those workers reported by the farmer is that most of them previously worked at the state farm, where they learned tapping techniques: *“Hired laborers are well known for their excellent tapping skills. In the off-season they may leave ManDian to get a job as a construction worker. The relationship between the villagers and the hired laborers is very good. The villagers usually invite them to family events like weddings”* (Farmer).

In the interview, the two workers (around 40 and 45 years old) confirm most of this information. They settled in ManDian in 2007 and started working on a farm with a total area of 100mu and 3,100 rubber trees. The farm that they cultivate is rented by an outsider from another village who rents the land from two different owners. They live in ManDian full-time except for small periods in the off-season when the men may go to Jinghong to find construction work.

Payment contracts lasting three years have decreased from 40% of the rubber sales to 33%. Payments are received monthly after the final rubber harvest of the month; this means that the laborers do not make money in the off-season since the rubber trees are not producing latex. The contracting agent does not do any management or cultivation; rather he helps to make management decisions for planting and provides all agricultural inputs including tapping tools, transport, and agro-chemicals. If there are problems with trees, the laborer will tell the agent who will have the solution implemented. It is evident that the agent lays much trust in the laborer as he only visits the farm 3 times per year.

The hired workers felt that they enjoy living in the community of ManDian, having good relations with the villagers. Leasing land on their own is not an option they consider due to the lack of financial resources.

From their statements it can be concluded that the hiring of workers for rubber cultivation is an emergent phenomenon that can be expected to increase. Since hired laborers share the profits of rubber sales they have an interest in improving management; however, they lack control on decision-making, a fact that places them in a vulnerable position.

6.6 Other Stakeholders

Apart from the farmers there are a number of other stakeholders: Traders, forest rangers and non-rubber farmers who are involved in rubber cultivation and processing. Due to time constraints, interviews with these stakeholders could not be carried out in this study. Therefore, the following sections will only present a brief introduction of the other influential groups. Even though these stakeholders influence the rubber cultivation and process, the model of diffusion of innovation is not applicable in this section, as they have not initiated rubber cultivation.

Traders

Traders buy liquid latex to process it to dry latex. According to the villagers, during the tapping season traders come to the villages every day to buy the latex. In most cases, farmers

stated that they would rather call the various factories to get the best price for the latex and deliver it directly to the factories. Especially “... *through road improvements, individual farmers no longer depend on traders picking up the goods and dictating the prices or on village cooperation to coordinate marketing processes*” (WEHNER 2011: p. 59).

Farmers who do not process the latex or those without transportation mostly sell to the trader, who would deal with the factory. This business model can result in a long-term cooperation between farmer, trader, and factory (Farmer).

Several farmers talked about problems and incidents with the traders, who would promise a certain price on the phone but then pay less after delivery. Also, one trader took off without paying the farmers at all.

The main reason for many farmers to process and sell their latex themselves is to cut out the middle-man and to thus make a higher profit (Farmers). In general, the traders are trusted, with some farmers even handing over the unweighed latex in return for a fair price (Farmer).

Forest Rangers

Every village has its own forest ranger appointed by the NRWNNR Bureau. All of them are also rubber farmers as they only receive a little extra payment for this part-time job.

The ranger has to take care and protect around 500 mu of the public forest. His duties include protecting the trees from fire and illegal deforestation as well as to teach the villagers how to protect the forest.

Non-rubber Farmers

There are several farmers within the NRWNNR who cultivate other cash crops than rubber. Farmers from different villages rent out their land to outsiders who grow bananas on the land (Naban, ChaChang).

In the case of Naban, a businessman from Guangdong rented land from many villagers for his banana plantation. He only hired one worker from the village and was not integrated as he also lived further away from the village.

One banana farmer who moved to ChaChang in 2011 was interviewed for this research. He has a six-year contract for 80 mu. While he considered banana as more profitable than other fruits, he also stated its cultivation was particularly risky and required specific professional skills. Due to the bad infrastructure to his plantation there would not be enough manpower available and thus the payments for the workers were higher than in other areas.

Farmers do not see the banana farmer as a competitor for the land as they also make profit from renting out their land. When asked why they do not cultivate bananas themselves, the farmers responded that they lacked the knowledge.

7 Stakeholders' Problems and Problem Perception

The following chapter will give some insights on the stakeholders' problems and their perception towards economic, ecological as well as social impacts of expanding rubber cultivation in the NRWNNR, and the resulting transformation of a traditional subsistence livelihood towards a cash economy.

Picture 19: Dragon fruit plantation on the way to Naban



7.1 Ecological Problems of rubber cultivation in the NRWNNR

Taking into consideration that rubber is usually planted in monoculture which degrades soils and that the region is made up of subtropical, mountainous rainforest with poor soil fertility (TANG et al. 2010: p. 7), negative effects on the ecosystem are likely. Replacing traditional swidden agriculture with monoculture leads to a decrease in (agro-) biodiversity. Extreme weather events such as storms and temperature changes also pose a risk to the rubber forests and to people's livelihoods. This goes as well for the unprecedented intensive use of fertilizer and pesticides (TANG et al. 2010: p. 7).

7.1.1 Diseases and Pests

Many farmers possess knowledge about how to deal with pests and diseases and are therefore confident about the abilities to cure and mitigate them. Sulfur is a commonly used measure for prevention of the fallen leave disease and is applied in quantities of roughly 1.6 to 1.8 kg per mu (Farmer).

Table 10: Timeline weather events and Pests/Diseases

Year	Pests and Diseases	Weather Events
1998		ZhongZhiChang: Cold weather destroys 600 of village head's trees
1999		Kemu Village: Snowstorm destroys rubber harvest of LuoZhongPing
2000	Kemu Village: Fallen leaf disease delays tapping until July	
2003		ManDian: Hailstorm destroys almost 90% of seedlings planted (reported by HuiYao)
2008		ManDian: Storm brings serious losses to rubber plantations
2011	Kemu Village: Red Spiders damage rubber crops	
2012	ManDian: White powder disease has been occurring many a time	Kemu Village: Widespread drought damages rubber crops
	ManDian: In recent times, an unknown disease is affecting the rubber plantations in ManDian village. No cure is found up to date	

Picture 20: Unknown rubber pest in rubber trees, MandDian



Diseases and pests mentioned during the interviews include white powder disease and the red spider. However, most of the times farmers are unable to recall exact dates of pests and diseases occurred (see Table 10). A farmer from Kemu reported that 'red spider' occurred in his plantations and caused a decrease in latex production by around 30%. Consequently, all farmers in the village gathered together to apply pesticides.

Another disease mentioned in Kemu is the fallen leaf disease. It occurred around the year 2000 and delayed the tapping for three whole months (until July), which meant a loss of income for the farmers. Farmers only could continue to spray pesticides to protect new leave growth and had to wait for the trees to regenerate. Access to pesticides heavily depends on farmer's wealth and their connections to Jinghong. Villagers often do not seem to realize how vulnerable the monoculture based economy is to destructive outbreaks. Most farmers do not relate epidemics with monoculture of rubber trees. Instead, they relate pests and diseases to climatic changes.

Even though farmers generally feel confident on how to treat pests and diseases, a farmer from Kemu mentioned a lacking ability of correct management of fertilizers and pesticides. According to a farmer in ManDian, there is an unknown disease that has been spreading in the area recently and up to now can't be cured. The leaves of the rubber tree turn yellow initially and the wood is dotted with little holes. Even though farmers assume it is a pest, no insects could be found when cutting the trees. To prevent further spreading on the plantations, infected trees have to be removed including the surrounding soil.

7.1.2 Weather Events

Throughout the villages, weather events and natural disasters are perceived as a problem when it comes to rubber production. The events mentioned are manifold, ranging from storms to drought. Storms that occurred in ManDian village, for example, brought losses to the local rubber farmers in the year of 2008 when they destroyed a big part of the rubber plantations. Other natural events include droughts, which occur regularly in the region. *"In 1999 a storm occurred which killed 600 of my rubber trees. Another time I've lost 200 trees due to wind damage. The biggest economic damages are caused by natural disasters"* (Farmer).

It is important to note that farmers do not receive any kind of compensation by the government or any other type of institution when it comes to losses of latex production or damages to plantations.

A farmer said: *"I am aware of increasing losses of topsoil through wind and water events. For this reason, ManDian villagers have started planting trees only in flat areas instead of using slopes."* ManDian also experienced a heavy hailstorm in 2003 which in addition to damaging village infrastructure also caused harm to the rubber trees. One farmer claimed that 90% of the newly planted seedlings were destroyed.

According to farmers from Kemu, weather events are the biggest problem when it comes to rubber cultivation. The last drought happened in 2012, lasted for one month and delayed the tapping season: *"A drought in April 2012 caused a huge economic damage to the farmers in Kemu. We couldn't tap the trees for a whole month, otherwise the trees would have become sick."* Farmers furthermore *"... have the feeling that extreme weather events had increased over the last years."*

7.1.3 Changes in microclimate due to rubber production

The new level of socioeconomic well-being has been achieved by cultivating fewer varieties of crops in areas with rubber plantations. Commercialized plantations have replaced the traditional fallow systems, hence also loss of traditional rice varieties (YONGNENG 2005: p. 11). Today rubber is cultivated in even lean and marginal soils which formerly were only used to cultivate specialized rice varieties. This haphazard planting is leading to erosion.

The most striking ecological consequences are the drop of groundwater level; and reduction of winter, mist, and fog. Local climate records show that average fog days in winter were reduced from 115, 128 and 159 in the 1970s to 30, 97 and 98 in 2005 respectively in Jinghong, Menghai and Mengla. Rubber trees are large water consumers. Additionally, since rubber trees are not as densely planted as natural forest, more water is lost due to runoff. Less water is stored in soil therefore less water can evaporate (TANG et al. 2010: p. 1081).

Many farmers are aware of the fact that intensive rubber production can decrease water levels and even lead to the disappearances of small rivers: *“Yes, I have a strong feeling that if we plant so much rubber there will be less rain and less water to drink”* (Farmer).

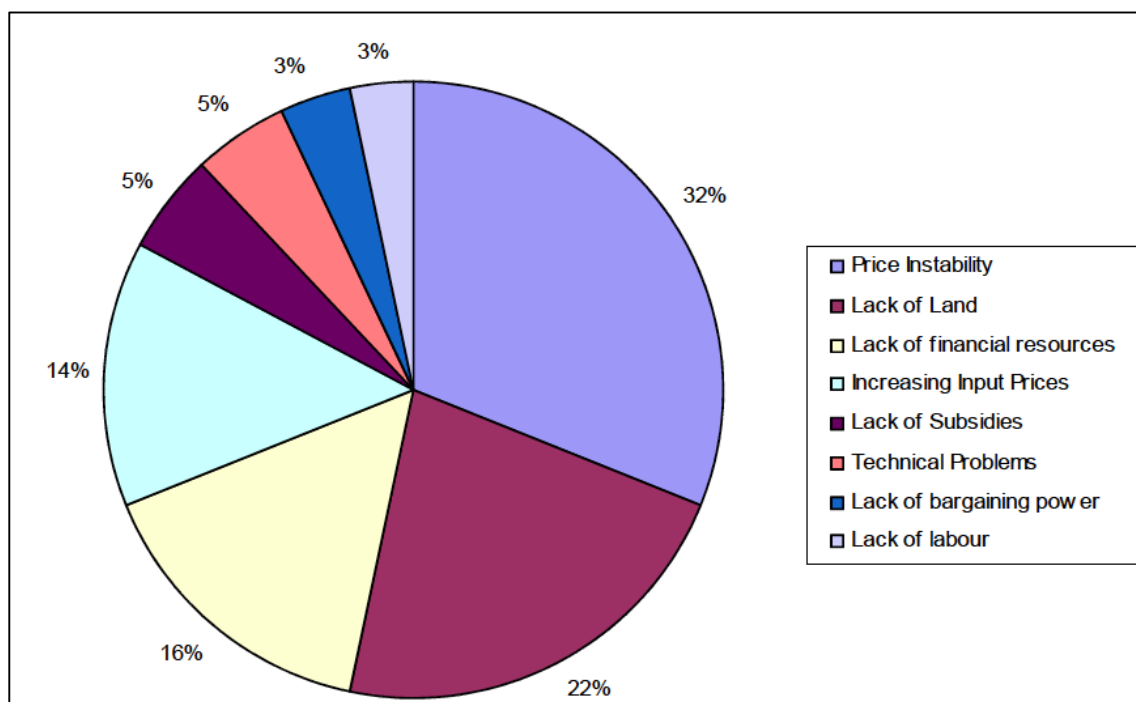
In fact, the drying out of land is regarded as the most important environmental change farmers are experiencing. Some farmers also note rising temperatures in the areas: *“I don’t know why, but I noticed that the rain is getting less and the soil is drier than before”*.

While some of the interviewees regard these environmental changes as directly related to the increasing rubber plantations, others do not. According to a farmer from ZhongZhiChang, more trees are better for the environment. A farmer from BanQianDi said: *“I think there is no effect on the environment. I think the changes in the environment have nothing to do with rubber cultivation. Also, rubber prevents soil erosion because it covers the soil better than corn and other crops.”*

7.2 Economic Problems

The rapid expansion of rubber cultivation in the NRWNNR was mainly triggered by the high domestic demand for natural rubber linked to the focused development of China’s automobile industry by the government in the 1980s (AHLHEIM et al. 2012). This development was accompanied by an overall institutional transformation and a change of the current tenure system. Governmental institutions began to focus on poverty reduction, agricultural innovation and an overall economic growth, especially in rural areas. In order to achieve the set objectives, incentives were given by the state, aiming to improve the overall regional economic performance (WEHNER 2011). Providing smallholder farmers with subsidies for rubber cultivation is just one example of public support towards an economic growth on the regional level. After the reform of the Chinese agricultural system in the 1980s, rubber cultivation began to spread throughout the research area, resulting in an overall economic growth. Even though the initial phase was not beneficial for all the newcomers, mainly due to a lack of knowledge and skills, the expectations were finally met.

Figure 14: Economic problems listed by the respondents (n=55)



This section will examine market dependency and economic vulnerability; two main problems which arise from such a rapid economic development and the renunciation of traditional income diversification.

7.2.1 Market Dependency and Price Instability

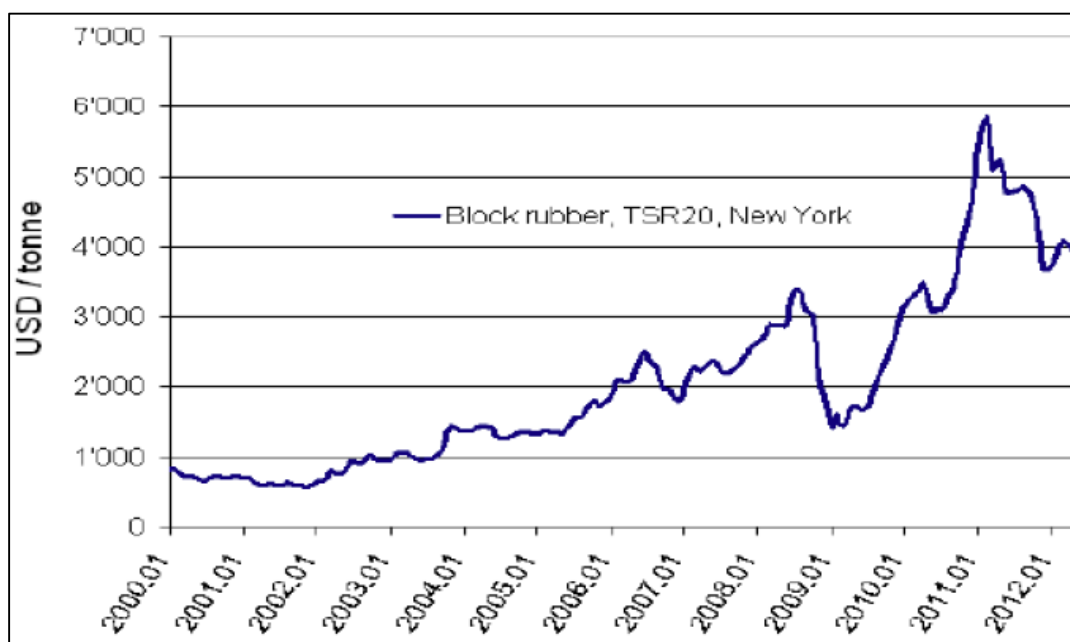
The traditional subsistence farming system in South East Asia is characterized by a risk management system, including the diversification of crops. Instead of striving for maximum yields, farmers rather cultivate traditional crops to sustain their livelihoods. This attitude has drastically changed in most parts of the research area since the introduction of rubber. From an economic point of view, increasing dependency on rubber as a monoculture poses several problems to farmers.

Figure 14 shows the economic problems which were mentioned by the respondents. Among these the price instability of rubber was considered as the most negative economic factor.

“Another problem is price instability. The effects depend on the wealth of the families. Families who have enough savings can process the latex and store it until the price is higher, but poor families might need to sell it in order to buy food and other urgent expenditures, no matter if the price is low.” (Leader of women group).

“We have experienced price fluctuations. They caused huge income decreases in the past. I give an example: In 2011 the price for solid latex was 30 RMB/kg; in 2012 it dropped to 18 RMB/kg.” (Farmer).

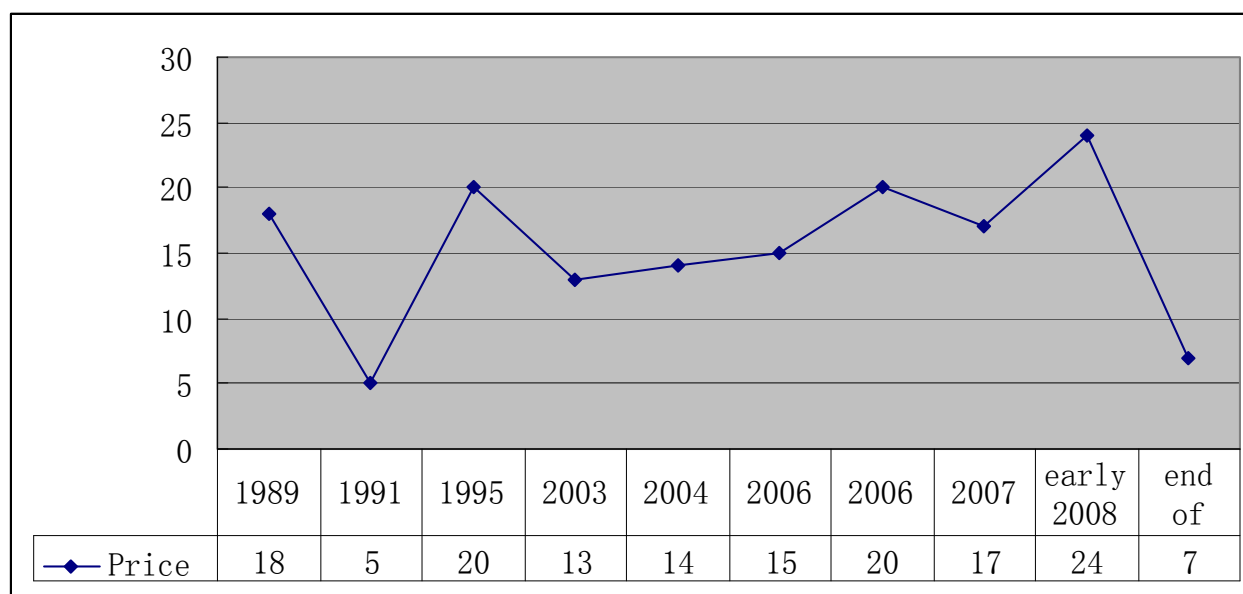
Figure 15: Monthly average free market rubber prices, January 2000 - April 2012



Source: UNCTAD 2012

Unlike hybrid rice or hemp, rubber prices do not undergo governmental intervention, such as the determination of a minimum price (TANG 2013). The price development of rubber is driven by the international and national markets. Price fluctuations occur rather often as the market price of rubber is dependent on various factors. Figures 15 and 16 show the monthly fluctuations of rubber prices on the free market and the price development of dry rubber in the NRWNR since 1989.

Figure 16: Dry rubber price fluctuations in the NRWNR (RMB/kg)

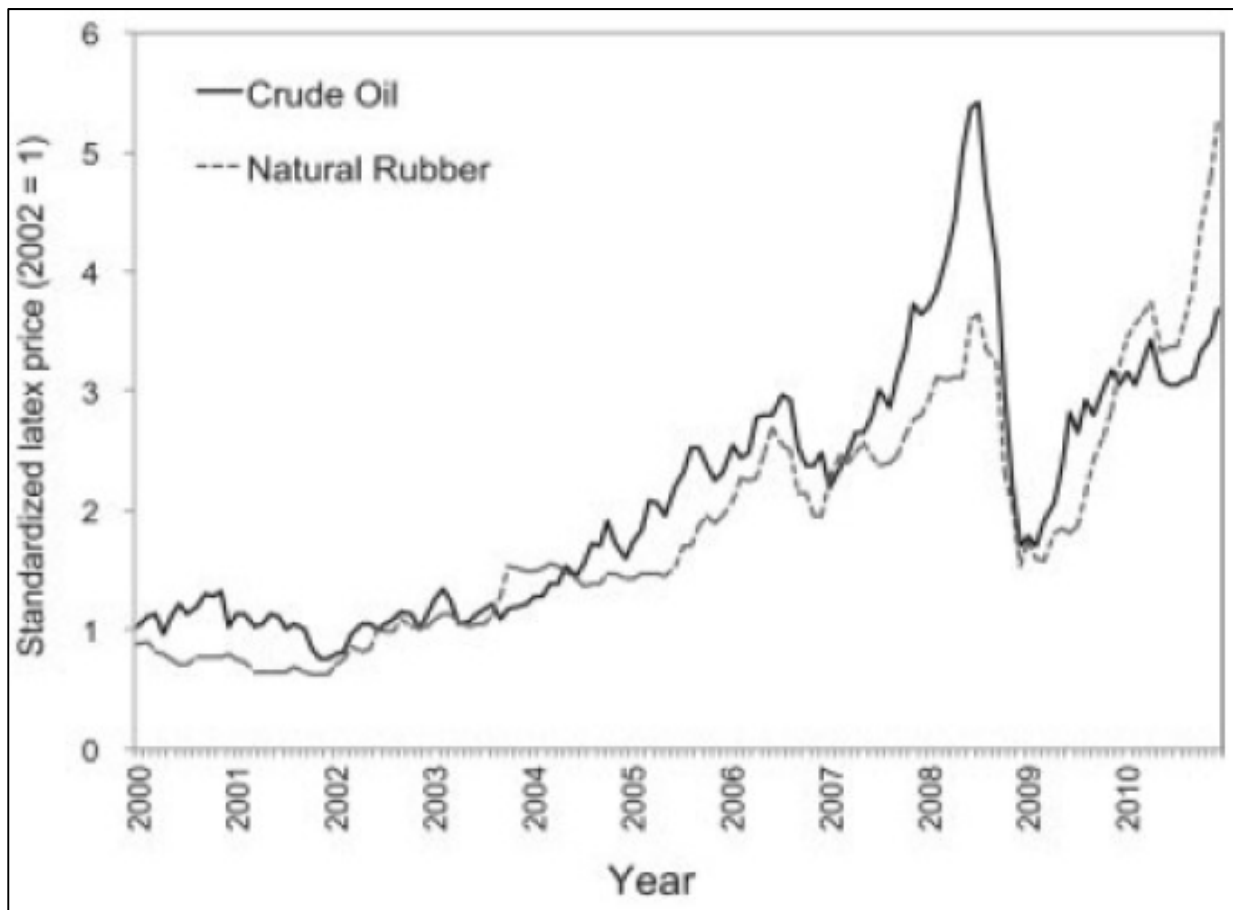


Source: TANG 2013: p. 77

One of the main influencing factors, besides the global economic development, is the dependency of rubber on crude oil prices. Crude oil is the principal raw material for the production of synthetic rubber. As synthetic rubber is a substitute for natural rubber, the price for natural rubber adjusts to the market price of crude oil (Figure 17).

Another risk avoidance mechanism in former times is the geographical distribution of plots (WEHNER 2011). In the research area, most of the rubber farmers today have their plots consolidated in a single spot. Due to lack of time and labor force and the fact that they tap their rubber trees during the night, farmers cannot manage to move between different locations. The concentration of plots has a highly negative influence on the vulnerability of farmers. For example, if a pest or disease occurs the whole plantation is affected. The distribution of the plots in former times functioned as a buffer against natural disasters. *“The safety principle is born from the ecological dependency of farming livelihoods.”* (WEHNER 2011: p.142).

Figure 17: The price adoption of natural rubber to the price trend in crude oil



Source: ARS 2010

7.2.2 Economic vulnerability

The vulnerability towards economic impacts varies highly between upland and lowland villages. The economy of villages above the rubber limit can be considered more flexible as

compared to the lowlands. Tables 5 and 6 in section 5.6.3 give an overview of the diverse income sources of the respondents. ChaChang, Kemu, ManDian, Naban and Pabin have a rather low level of income diversification which reduces their ability to adopt in times of need. The communities highly depend on rubber as a main income source. But since new varieties of rubber, which can also be cultivated in higher altitudes, were introduced to the upland villages in the NRWNNR, the share of income arising from rubber is constantly increasing. Even if “... *both upland and lowland villages have maintained the possibility of returning to more subsistence-oriented production systems*” (WEHNER 2011: p. 143) the results of the present study suggest a highly decreasing tendency.

Due to their rising economic well-being farmers in the lowland areas do not see the need of subsistence farming anymore, as they enjoy the benefits of increased purchasing power.

Nowadays, the profitability of a crop plays a decisive role and decides on the respective farming system. At present, there is no other crop which is more profitable than rubber. Even if farmers in Kemu mentioned that the cultivation of dendrobe could be more profitable, a lack of knowledge, land and access to markets continue to hamper the improvement of production systems. A farmer from Kemu said: *“I have failed to cultivate dendrobe due to a lack of knowledge and skills. My fields died after 2 years ... The government contracted a dealer who provided some information about the cultivation of dendrobe to the villagers in Kemu. The dendrobe dealer also told the community that he can guarantee a price of 50 RMB/kg for the first three years. In the third year he just offered us a price of 25 RMB/kg. The cooperation with the dealer is the only relation which exists concerning dendrobe. The dealer is the only person we can contact when a problem occurs. That’s why we also continued to sell the dendrobe to him even he halved the kg price for dendrobe in the third year.”*

The opportunities for farmers to generate income through off farm activities remain low. The wage labor sector in the NRWNNR is rather small (WEHNER 2011). During the off-season of tapping most of the farmers are engaged in construction work in Jinghong City. Some of the households are also running (part time) restaurants and small shops, but the profits are rather small since the tourism sector is almost non-existent. ManDian for example, used to be a popular traveling stop for tourists until 2007. The nearby Naban waterfall was a tourist attraction. Due to the construction of a dam in the area the waterfall disappeared and so did the tourists.

“The villagers used to have restaurants and sold handicrafts or other homemade products to the tourists. This used to be an alternative income source for elders, who are not able to tap anymore. Also children worked as tourist guides and received 50 to 100 RMB/day” (Farmer).

Today, the Administration of the Naban River Watershed National Nature Reserve is one of the largest and most reliable employers in the region. A detailed description of alternative income sources is also given in section 5.6.

7.2.3 Economic Inhomogeneity

With the implementation of the HRS in the NRWNNR in 1982, a socio-economic transformation took place in the region. Local farmers started to improve their livelihoods by cultivating new cash crops (TANG 2013). Besides hybrid paddy rice, rubber was by far the most profitable and successful one. With the abandonment of traditional crops, the local farmers gave

up their self-sufficiency. It needs to be stressed, however that “self-sufficiency” was far from stable and secure. Periods of hunger were frequent and this is still part of the social memory of villagers.

Today, the NRWNNR is characterized by social and economic inhomogeneity (WEHNER 2011). The wealth gap continuously grows. Disparities concerning the income situation in the upland and lowland regions in the NRWNNR appear to be dramatic. While the lowland villages have already been transformed into market oriented cash economies, most of the communities above the rubber producing elevation continue to depend on subsistence farming. A staff member of the NRWNNR, who promotes the diversity of plantations in order to lower the risk of monoculture, said: *“Villages which do not produce rubber are poorer. They generate their income from tea, corn and chicken. They achieve an average income of 20,000 RMB per year. Here in ChaChang the average is around 50,000 to 60,000 RMB per year.”*

The socioeconomic disparities continue to grow, also due to rising input prices: *“First, I bought grafted seedlings in Jinghong for 4-6 RMB. Last year I started to collect seeds, because I could not afford the grafted seedlings which then cost about 15 RMB.”* (Farmer)

Due to degrading soil quality, the demand for fertilizers and pesticides is constantly increasing. In many cases there is a lack of money to purchase these chemicals. Those who are able to afford the rising input prices will continue to increase their cash income, those who are not will remain in a weak economic position, resulting in the continuously widening wealth gaps mentioned above.

7.2.4 Changing Marketing Patterns

Accompanied by the transformation from a subsistence economy into a market economy, the process of a diversification of marketing strategies took place in the research area. Trade became an impersonal exchange of goods with a rather low level of transparency (WEHNER 2011). As the results of the research show, the majority of the respondents prefer to sell their latex directly to the factory instead of marketing the rubber through middlemen. The marketing strategies have changed. In the beginning of rubber cultivation, most households sold the liquid latex to a dealer on a daily basis. Today, due to increased processing skills and the existence of storage facilities the marketing strategies are more diverse. None of the respondents mentioned a personal relationship to one of the traders. In some cases mistrust, due to negative experiences in the past, was reported.

7.2.5 Land Leasing and Renting

The number of land-transfer activities has constantly increased over the last decades. The lack of financial as well as labor resources for further investments is one of the most important drivers for land leasing in the research area. A farmer from Pabin said: *“The decision to rent out land depends on the economic status of a household. The reason to lease land and share the income is the lack of initial investment. It’s always the second choice to share the profit.”*

Several problems occur which are directly linked to land leasing and renting activities in the research area. These can be summarized under the terms ‘*Diminishing Adaptability*’ and

'Land Scarcity'. As villagers become more attracted to the idea of profiting from their land, either by renting out their arable land or by planting rubber monoculture, they fail to consider their future ability to adapt to a crop failure. As mentioned earlier in this chapter, ecological problems concerning rubber cultivation are increasing within the NRWNNR, especially the frequency and quantity of pests and diseases. In South America, the center of origin of *hevea brasiliensis*, a fungal disease caused by *Microcyclusulei*, known as South American Leaf Blight (SALB), has stopped the whole rubber production in the Amazon Basin (BOER and ELLA 2000). Neither the farmers nor scientific experts were able to cure the disease. Every attempt to control SALB failed. If such a disease would occur in the NRWNNR, the outstanding majority of the households below the rubber line would be ruined. In Kemu for example, where farmers exclusively cultivate rubber and dendrobe, food security would be seriously endangered.

Another precarious aspect concerning the decreasing ability of farmers to adapt in times of emergency is the problem of long term renting schemes. If the lessor wants to end the contract with the lessee before the fixed termination of the contract duration, the lessor would have to return the full renting fee. According to farmers in Kemu and Pabin, most contract terms even require to pay back treble or tenfold of the original amount, which is often impossible for the lessors.

Land scarcity is one of the most striking factors, especially in lowland villages which already perform on a high economic level. Farmers in Kemu said: *"At present it is impossible to expand our rubber cultivation as there is no additional land available."*

Picture 21: Rubber cultivation on slopes



“Purchasing land from surrounding villages would be a possibility but requires a lot of financial resources, as the price for land is very high.”

“Since the village has no more land left for cultivation the villagers would have to purchase land elsewhere but since all the nearby villages also plant rubber, it is hard to rent or buy any land. The land is also very expensive.”

Due to land scarcity, the present status of rubber cultivation in the lowlands has stagnated. In order to address this problem, farmers are in need of new varieties and alternative income strategies.

7.3 Social Problems

In former times, socio-economic inequality within villages did not automatically lead to potential conflicts among the villagers. Quite to the contrary, it supported the creation of a social network, based on reciprocity and cooperativeness (WEHNER 2011). Even if conflicts do not seem to occur frequently, at least within the villages, the increasing cultivation of rubber has a high impact on the social lifestyle of the communities in the NRWNNR. Therefore two main aspects will be discussed in detail: the decreasing level of cooperation among farmer households and the general change in lifestyles.

7.3.1 Low Level of Cooperation

A rather low level of internal as well as external cooperation of the communities was observed and mentioned several times by some respondents during the study. Although the families help each other in cases of house construction, or would ask their neighbors for small loans, the overall level of mutual support is declining. Asked about the changes within the community since the cultivation of rubber, a senior farmer from ZhongZhiChang said: *“Before the people in the village started cultivating rubber, we had a lot of leisure time. We went out to visit other houses and chat with other villagers. Since the beginning of rubber cultivation, today we have less free time. The people have to work more, especially during the tapping season. They come back late from work and cannot do much else (...), the people do not have the time to help each other, because all of them need to tap their own trees.”*

Table 11: Daily schedule of a rubber farmer during tapping season

Time	Activities
2 am – 7 am	Tapping
7 am – 12 pm	Collecting latex yield; either store it at home or sell it directly to a dealer
12 pm – 2 pm	Lunch
2 pm – 4 pm	Rest
4 pm – 6 pm	Cultivation work (e. g. weeding, fertilizing)
6 pm – 8 pm	Dinner
8 pm – 2 am	Rest

Table 11 shows a daily life schedule of a farmer couple during the tapping season. Since rising day temperatures lead to a faster natural coagulation of the latex, and therefore an accelerated sealing of the cut, the tapping is usually done at night or in the early morning in order to achieve maximum yields.

Due to the given working conditions of a rubber farmer, there has been a significant shift of the everyday life in the target region. A farmer said: *“When I was a child, we had more time to talk within the community. But now we work at night and rest during the day so it becomes less.”*

Another aspect which contributes to an overall alienation among the households is the declining number of social events. According to a farmer in ManDian, the importance and occurrence of religious celebrations is constantly declining among the younger generations.

7.3.2 Leisure Time

Quite the opposite picture emerges in villages which are still in their initial phase of rubber cultivation. Depending on the size of the rubber farm and the number of mature trees which can be already tapped, farmers either do have to deal with a lack or a surplus of time. Farmers from BanQianDi and Pabin said: *“Now I have more free time, since the cultivation of rubber is not that labor intensive as the other crops I have cultivated before. I can use more machines, which reduces my personal labor input.”* *“Before rubber I couldn’t rest the whole day. Nowadays I have plenty of time to have a rest.”*

Due to the high amount of leisure time, drinking and gambling became part of the daily routine of various farmers in recent years. A farmer from Pabin said: *“Due to the fact that the men drink a lot during the night, they hurt the rubber trees by incorrect cuts and thereby decrease the production.”*

7.3.3 Changing Lifestyles

Because of higher incomes, the purchasing power of rubber farmers has increased dramatically in recent years. These days, every household in the research area owns at least one car as well as a motorcycle, television, and cell phones (TANG 2013). The meaning of status symbols has reached a new level. A farmer from ChaChang said: *“Everything in my life goes well, not just economically. My family members live a better life. We can buy more diverse food and more clothing. Additionally, I can invest in electronics and furniture.”*

The farming community in the NRWNNR is slowly turning into a consumer society. Life is becoming more convenient. The displacement of traditional clothing is a good example. The leader of the women group in Kemu said: *“Villagers used to wear clothes made by themselves. Currently they buy clothes in the market.”*

In former times farmers used to purchase their products on regional markets. Today, traditional markets have almost disappeared in the region. The farmers’ profits were too low so markets have lost their appeal (WEHNER 2011). Also the amount of arable land is constantly declining. Farmers do not produce a surplus anymore. If households are still cultivating some arable land, they use it for personal requirements. In villages like ManDian or Kemu, the high level of income allows the people to purchase all of their food. They are not in need

of subsistence farming anymore. Further consequences regarding the low level of diversification of income were discussed earlier in this section.

Picture 22: Motorcycle in ManDian



Another obvious change of lifestyle is the movement away from traditional wooden houses to concrete buildings. All over the research area, construction work was observed. Asked about the changes in lifestyle since rubber, most of the respondents firstly mentioned the ability to afford the building of a new, concrete house: *“My life has become better since I have been cultivating rubber. I have enough money to buy everything I want. I built a new house and bought electronics”* (Farmer).

House building in former times was the responsibility of the family and community. Today, the families prefer to commission a construction company.

Another aspect is the overall declining number of livestock in the NRWNNR. During the field research, BanQianDi and Naban were the only villages where buffaloes could still be observed. In former times, they were used for tillage and therefore had a high value to the farmers. Today they are replaced by modern machinery. Even the farmers in BanQianDi would rather sell the animals instead of keeping them. Villagers raise them because they are able to achieve a sales price of 5,000 up to 6,000 RMB per animal.

8 Stakeholders' interests and attitudes towards rubber cultivation

The focus of this section is on the stakeholders' interests and ambitions. This reflection deepens our understanding of the respective stakeholders their needs and motivation for growing rubber.

Consequently, the research objective of this section is to identify the interests and ambitions of the stakeholders in order to understand the stakeholders' needs and wishes for the future. This is vital to a proper understanding of the current and future trends of the villagers. In the long run this knowledge about the stakeholders' interests can be essential for the SURUMER's future communication and implementation phases towards stakeholder participation and the overall goal of more sustainable rubber cultivation.

The following section has been divided into two parts. The first part deals with the interests and ambitions for the future of the stakeholders in general. The second part focuses on further ambitions and interests concerning the production of rubber. Ideas which were expressed frequently are addressed first, followed by statements which were given less often.

Excursus: Limitations to the research questions

In comparison to the other aspects of this stakeholder analysis, questions towards stakeholders' interests and ambitions have not been answered often by the respondents. This could be because of the rather abstract question, which makes it more difficult to answer, or it could be a cultural implication which does not make it adequate to ask such a question. Another possibility is that the question simply has not been asked in every interview. For future interviews it is essential to keep in mind that this information is relevant and that it does make a difference.

Thus some researchers rephrased the question, "What do you wish for your future" into "What do you wish for the future of your children". However, since the questions were not standardized and the interviews were rather open, with more people around and sometimes interfering, the results for these questions simply show some general wishes or ambitions of some of the village inhabitants. These limitations of the data should be kept in mind, before generalizing the findings.

Nonetheless, some ambitions and interests are mentioned by several people, whereas others were only mentioned by one individual.

8.1 General interests and ambitions of the villagers

Within this section the different general interests of the villagers are identified. The interests are: Better education for children, increase in wealth, more government support, and continuation of the status quo, a better/different job, family health, and tourism.

Table 12: Number of people stating the same general interest

	Better education for children	Increase in Wealth	More government support	Continuation of Status Quo	Better/ Different Job	Family Health	Tourism
ManDian	1		2	1			1
Kemu	3						
Huilao	1	1	1				
Zhong-ZhiChang		2					
BanQian Di	1	1	1	1	1		
Pabin	1	1		1		1	
ChaChang	1	2	1		1		
Naban	1			1			
TOTAL	9	7	5	4	2	1	1

As indicated in Table 12, some trends regarding the interests of the respondents can be shown. Many are interested in better education for their children. Education as such is free of charge in China, but most of the villages are not located close to a high school. Thus, for further education the children have to stay in a boarding school and the parents have to pay for accommodation and meals. Most of the elderly people did not receive any formal education at all. The interest in higher education for the next generation is correlated with the interest in an increase in wealth. Many interviewees stated that they would like to receive a higher income.

In connection with the interest in better education the wish for better or different jobs has to be seen. It was mentioned that the son or daughter of the family should work in the city or have a different job than being a farmer. This statement is remarkable and could be a first hint for upcoming social changes, since the wealth in many villages originates almost solely from growing rubber. Nevertheless some parents see the future of their children outside the agricultural sector: *“The economic situation is better now. I spend my money just on daily life expenditures. I can buy anything I like. I hope my children will have a better life in the future, more money. I don’t want my children to grow rubber, they should study and go to a good college and find a good job in the city. In case they do not receive good grades, they have to come back and cultivate rubber”* (Farmer).

Keeping in mind the enormous increase in the living standard of most of the villagers due to the cultivation of rubber, it is not surprising that some also mentioned that they are interested in a continuation of the status quo – meaning rubber cultivation and the linked perpetuation of the current high living standard, which is perceived as sufficient (TANG 2013: p. 97). This interest is also mentioned in the problem section, because changes in lifestyle and living standard can also lead to problems and might not have a positive connotation.

Other aspects mentioned by some of the villagers are interests in family health and the general wish for the establishment of tourism. Tourism is rather difficult to promote, because the villages are located in the “Nabanhe National Nature Reserve” and a further expansion of the areas belonging to the villages is not feasible (TANG 2013: p. 53).

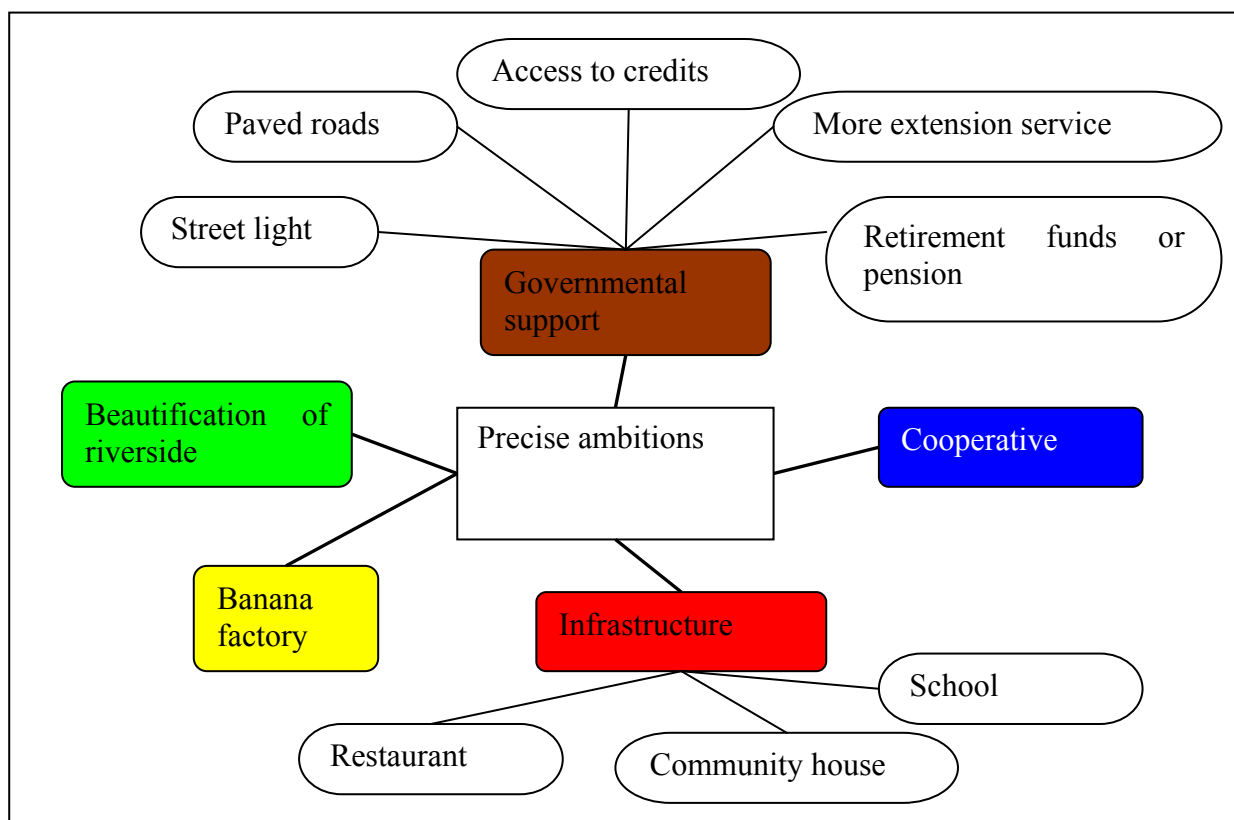
Picture 23: Everyday life in Naban



It is essential to realize that even with regard to the stakeholders' general interests, the life of the people in the villages is strongly connected to the production of rubber, since the revenues provide the basis for the interests most frequently stated: Better education and increased wealth. This holds true for most of the respondents in villages with high and lower current dependence on rubber cultivation. To be successful, especially in terms of social sustainability, future interventions need to address these interests by facilitating equitable income opportunities. As stated by the farmers, government support seems to be an option to enhance or keep up the present living standard in the villages.

Along with the interests shared by many villagers, there were also more precise ambitions expressed, often only by individuals (Figure 18): more government support; some interviewees listed infrastructure, such as street light or better transportation through paved roads; others access to credits; and more extension. Retirement funds or pensions for the villagers were also mentioned, as government pensions are not sufficient.

Figure 18: Precise ambitions expressed by individual stakeholders



The deputy head of one village specifically mentioned that he would like to have a school in his village, which points at the awareness of the importance of education. Another ambition for an improvement of the village infrastructure was the idea to open a restaurant in one of the villages, which could also be used for tourism. Another farmer wished for a new facility for gatherings: *“I also wish we had a community center as we don’t have one yet. Right now, we are using the deputy’s village house for our meetings.”*

In terms of cooperation among the villagers, the plan of one family is to build cooperation facilities and to manage a cooperative of many villagers, who intend to sell various ecologically produced products, such as Puer tea, mushroom and bamboo. The association should cover most of the parts of the production process, such as planting, cultivating, managing, processing, trading and selling. Besides, this cooperative should also be involved in eco-tourism to increase the benefits for their contributors. The construction of facilities is in progress. In ManDian one villager was particularly interested in the beautification of the riverside – potentially for tourism (Figure 18).

Another ambitious villager plans to build a banana factory close to his plantation. He wants to be responsible for the entire production process, including storage and a cooling house. In that way, it is possible for him to store the bananas when the price is low and thus be responsible for a bigger part of the value chain.

All in all, with regard to the overall goal of more sustainable rubber production, the interests expressed by the villagers show that improvement of the ecological situation in the reserve is closely connected to the parallel provision of economically viable alternatives.

8.2 Interests regarding rubber cultivation

In the following chapter, the specific interests of the villagers with regard to rubber cultivation are analyzed. These are: More land or increase in production, more knowledge on fertilizer or pesticides, intercropping techniques or alternative cultivation techniques, new varieties, ecological improvement, bargaining power, prices, and the stabilization of the current production (Table 13).

Table 13: Respondents stating the same interests and ambitions regarding rubber production

	More land/ increase in production	More knowledge on fertilizer/ pesticides	(Alternative cultivation) Intercropping Techniques	New vari- eties	Ecological improve- ment	Bargain- ing pow- er/ prices	Remain current pro- duction
ManDian		1	3	1			
Kemu	2	1	2	1			1
Huilao			-				
ZhongZhi Chang	2	1	2			1	
BanQian	3	1	1		1	1	
Di							
Pabin	1	3					1
Cha	3	2		3	2	11	
Chang							
Naban	1						
TOTAL	12	9	8	5	3	13	2

As shown in Table 13 the biggest interest of the villagers is to acquire more land and/or to increase the production of rubber. Due to the location of the villages and the environmental policy in the NRWNNR an expansion of the area for rubber cultivation through the cutting of forest is not possible. However, an increase in production could be possible with new varieties, which could be, for instance, placed on land in higher altitudes. Improved management through the usage of fertilizers and pesticides is also wished by the stakeholders. As stated in the problem section 7.2., several villagers perceive fertilizers and pesticides as too costly. More knowledge and capacities on both is of high interest for the villagers, as combined with the correct tapping it could enhance productivity: *“I have the impression that other villages are doing better in cultivating rubber. We are lacking sufficient fertilizer, which lowers our production and I can see improvement in terms of tapping skills and knowledge. Right tapping technology could increase the output and the quality of the latex.”* (Farmer).

Another important aspect is the high interest in alternative cultivation techniques, such as intercropping. This fact could be a good starting-point for the SURUMER consortium to propagate improved conservation practices. Some villages already started trials, for instance with tea. This, however, but did not work out, because the shadow of the rubber trees reduces the quality of the tea.

Picture 24: Latex flow of a rubber tree in Huilao



Also mentioned was the interest in better prices for rubber and more bargaining power. Due to the price fluctuation of rubber and price drops in 1991 and 2007 (TANG 2013: p. 95) this interest is comprehensible and also mentioned in the problem section 7.2. Some of the interviewees said that they sometimes sell the latex to businessmen and only get a reduced price for it in comparison to the price at the factory.

With this interest in mind, the future cooperative for the production of ecologically produced crops also wants to buy latex from their members to receive higher prices while selling it directly to the factory in Jinghong. Similar practical plans were made in ZhongZhiChang, which failed to be implemented due to problems in the cooperation among the farmers in the village.

Since the prices for grafted rubber trees are significantly increasing over time one farmer is keen on acquiring crafting skills and receiving training on that to be able to graft the trees by himself. He feels that otherwise he will not be able to buy new trees in the future.

Table 13 shows that two respondents were satisfied with the current production. It is interesting that several people stated to be satisfied with their current situation in general or the current production of rubber. This could also be a sign of the improvement in living standards in the villages over the last years.

Most of the respondents stated that they are aware of the environmental changes (see also section 7.1). They noticed decreasing water sources or fluctuating weather events, such as too

much or little rain. Without measures of ecological improvement, rubber production cannot be made more sustainable.

It is important to keep in mind that the villagers are not a homogenous group, but rather share only some aspirations while others have been stated by one or two individuals solely. Each and every villager faces a unique set of circumstances, environmental conditions and individual backgrounds that consequentially shapes different interests. For future implementation it will be a challenge to handle all the interest and/or provide knowledge which can be of interest to everyone.

There are six main fields of interest of influential rubber farmers:

- 1) **Increasing latex yield:** Since they are highly dependent on rubber cultivation, the first goal in short-term is increasing latex yield. Therefore, rubber farmers are usually making use of their contacts and networks to find out new information and knowledge.
- 2) **Improving cultivation methods:** This category comprises aspects of ecological and economic sustainability. Many rubber farmers associate the scarcity of groundwater to rubber production. While giving up rubber cultivation is not part of their plans, some farmers are interested in intercropping or improving cultivation methods to reduce the negative environmental effects. In economic terms, they are looking for more efficient methods to maximize profits.
- 3) **Enhancing financial capital:** This is the most frequently mentioned interest of rubber farmers who see in rubber cultivation a source of wealth and well-being for their families and villages.
- 4) **Changing lifestyles and consumption patterns:** Although this interest was not explicitly addressed during the interviews, it was widely observed that most of the rubber farmers and their families are changing their lifestyles, redefining their cultural background and ethnicity.
- 5) **Taking off in other profitable crops:** Some of the respondents are concerned about the disadvantage of being dependent on rubber cultivation. This may be due to the price fluctuation of latex or the recognition that land for expanding their rubber forest is limited. They are therefore interested in experiments with other cash crops that can be as profitable as rubber.
- 6) **Preserve connections to influential people:** Maintaining and strengthening linkages with the economic and political elite allow rubber farmers to have access to valuable information and participate directly or indirectly in decision-making processes.

9 Communication Networks in NRWNR villages

9.1 Types of Rural, Local Networks

When in the field, groups were able to identify three main types of networks: Social networks, institutional networks and value chains.

9.1.1 Social Networks

As presented in 2.3.1, KADUSHIN (2004) defines a network as “*a set of relationships*”, consisting of, among other things, individuals, groups, organizations and even websites. These objects are referred to as nodes which are then linked depending on the direction and nature of the relationship. If one visualizes the network as an object, one can observe the general shape and draw information about the logistics of the network. For this report the nodes are local villagers. The research carried out by the team classifies a social network as the villagers and those informal relationships they share. As stated earlier, 30 male and 18 female farmers were interviewed in eight villages. Each of these interviewed farmers has their own network of informal contacts. These informal contacts can include the workers they meet on a daily basis in the fields, as well as neighbors who live in close proximity with whom they can discuss topics related to rubber cultivation.

Picture 25: Gathering for leisure in Naban



In most villages, the idea of the family played a major role in the sharing of information. Many farmers' spouses had experiences working somewhere and then sharing the information they learned there. Marriages between members of different villages that are connected to other sources of information on rubber result in dissemination of information.

Other informal network members include outsiders and non-rubber farmers. The types of interactions that members of an informal network have are summarized in Table 14 below. Informal internal interactions take place at dinners, community gatherings, while gambling, or selling to a market. Informal external network interactions include regional gatherings.

9.1.2 Institutional Networks

In most villages, a community was made up of system of actors called the village head, an opinion leader, and villagers. According to TANG (2013), opinion leaders play an intermediary role between the user system, the institutional network and the knowledge dissemination system which includes the public extension sector, the private sector, and mass media. Tang found five opinion leaders in Pabin and four in ManDian, but in present research in the villages the study group identified village heads as opinion leaders themselves.

Village heads are elected by the villagers. They have the opportunity to access new information and knowledge and implement rural policies by the Chinese government. The NRWNR officials, also part of the formal institutional network, have been previously identified in this report as the villagers' link to promote better cultivation strategies, offering suggestions and sometimes extension advice.

Other formal network members include the forest ranger, hired workers, traders, and the public extension sector institutes. The informal and formal network interactions are summarized in Table 14. Formal internal network conversations could take place at village meetings, or within the village committee in a meeting. Formal external interactions take place at extension visits from the NRWNR or training programs.

Table 14: Informal and Formal Network Interactions

	<i>Informal</i>	<i>Formal</i>
Internal	Dinners Community gatherings Gambling & Games Cooperation in selling to market Personal relationships	Village meetings Self-organized knowledge sharing Village Committee
External	Regional gatherings Information from friends & relatives	Sanongtong Informational Alerts Extension visits Training programs

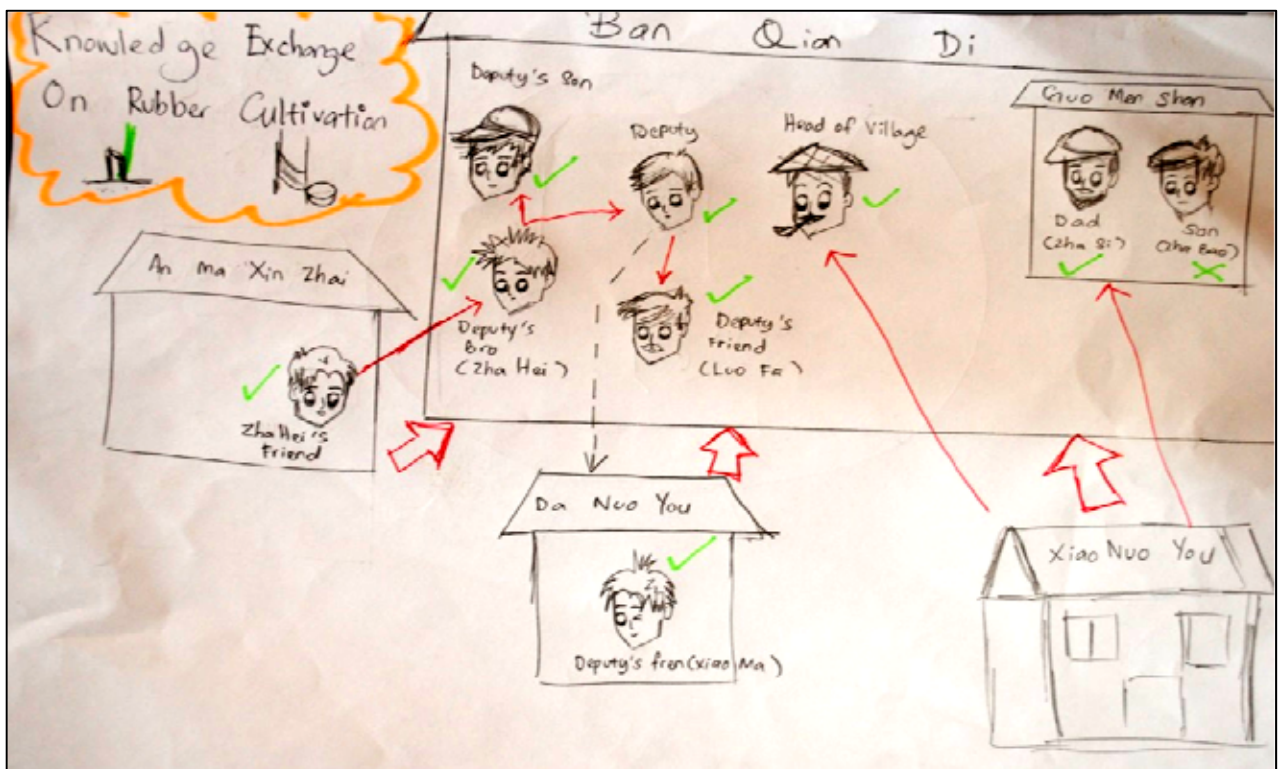
9.1.3 Value Chains

According to LA LONDE and MASTERS (1994) a value chain is a set of firms that pass materials forward. Normally, several independent firms manufacture a product until it reaches the end user in a value chain—raw material and component producers, product assemblers, wholesalers, retailer merchants and transportation companies are all members of a supply chain. LAMBERT et al. (1998) define a supply chain as the alignment of firms that brings products or services to market, and include the final consumer as part of the supply chain.

Another definition notes a value chain as the network of organizations that are involved in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (CHRISTOPHER 1992). In other words, a value chain consists of multiple firms including suppliers, distributors, and the consumer.

Only one example of planned cooperation and knowledge transfer was encountered in BanQianDi which is described in more detail in section 9.2.1. This initiative was prompted by the poor conditions for rubber planting and low income, mainly by a motivated villager. One of the principal goals of this cooperative is to capture more of the value created in the chain by cutting out the intermediary that the villagers currently contact in order to sell to the market.

Picture 26: Network in BanQianDi



Communication in other villages, although not as organized as in BanQianDi, is functional enough that some villages cooperate in marketing. For example, the delivery of rubber in Naban is organized by villagers and they collectively decide upon when to sell the rubber to the factory. If the market rate was too low they hold the rubber until the price increases and

gauge where to sell by calling different factories with their cell phones. Market information was accessed in the same way by individual villagers who dealt directly with the factories. Some of whom also stored their rubber until the market prices became more favorable.

The research group only analyzed stakeholders in the rubber supply chain, and included only rubber farmers and formal government stakeholders. The end user of the latex was not consulted. Earlier in this paper the role of the trader was briefly discussed, but only from the perspective of the rubber farmer.

9.2 Dissemination of information related to rubber cultivation

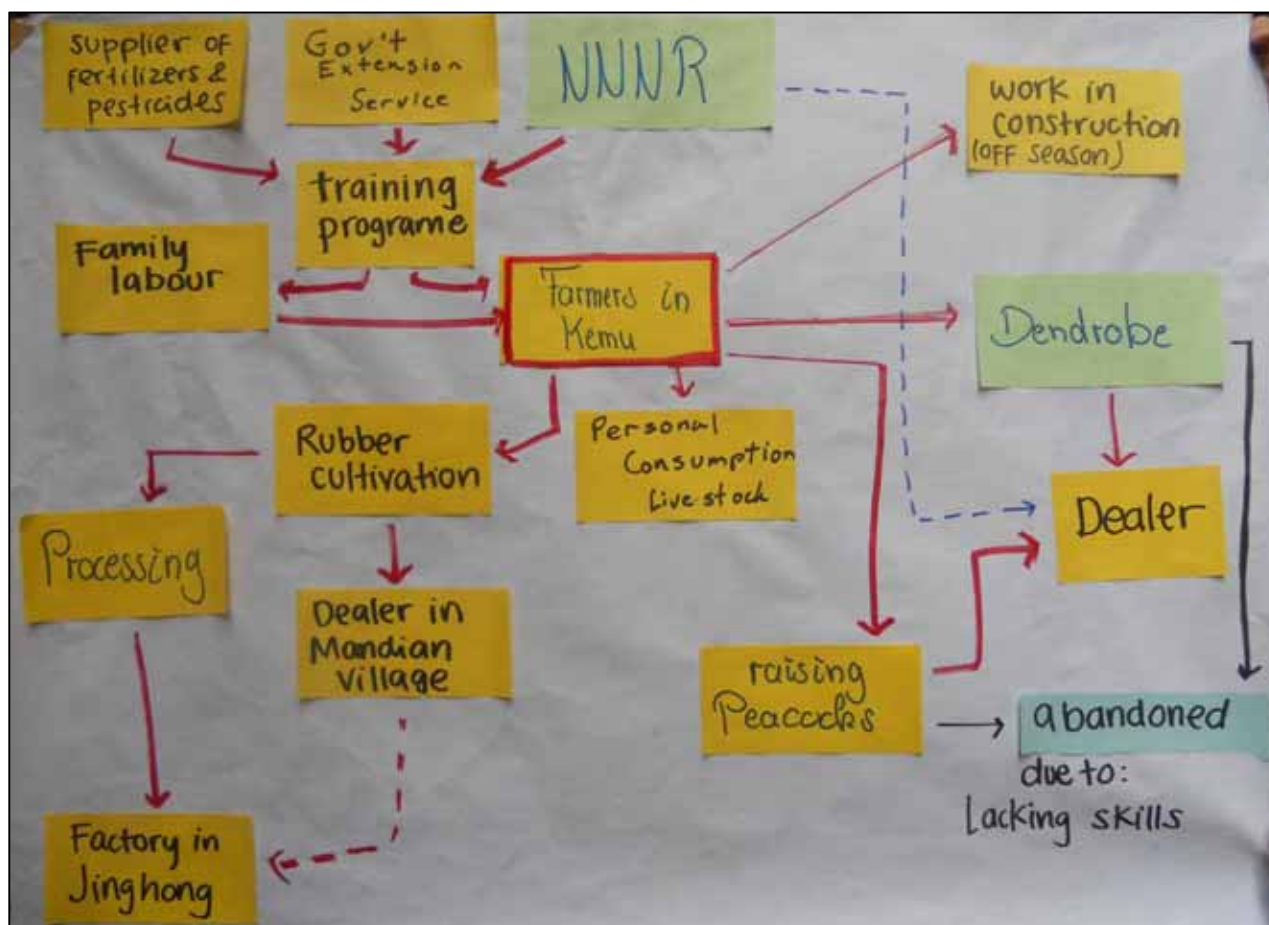
This subchapter identifies the means by which farmers obtain and share information about rubber cultivation. Information and knowledge about rubber provide a common denominator among farmers, extension workers and researchers (RAMIREZ 1997). Theoretical ideas on communication networks as discussed in section 2.6 (RAMIREZ 1997, WARRINER 1992 and CONLEY and UDRY 2001), previous research work of TANG (2013) in Xishuangbanna, together with information the study group obtained in interviews provide the basis for this analysis of farmer's communication networks. Findings from TANG (2013) are compared with field experiences in villages previously studied and villages that were researched for the first time.

9.2.1 Adoption of Rubber and Changes in Cultivation

The impact of factors such as credit, information availability, risk, and farm size have an effect on farmer adoption of new technologies. The economic environment of rural households in developing countries is also often characterized by the fact that some markets are missing. Future prices and the role of learning-by-doing shape the takeoff and new technology adoption (FEDER 1993). The information we collected from interviews with villagers show that adoption by farmers of rubber and other alternatives was connected to the wealth of other villagers living nearby.

As mentioned in section 5.5, the villages in the NRWNNR adopted rubber at different times. A farmer of ZhongZhiChang started planting in 1989, after learning the technique from the state farm. He shared knowledge with other villagers. Another villager in ZhongZhiChang began earlier in 1987. One villager and her husband started to grow rubber because they heard about people at the state farm getting profits from rubber cultivation. At that time other villagers also started growing rubber. In 1989, she received credit from government to plant rubber trees. The government gave her and her husband credits to buy the grafted trees that they had to return the following year. She knew about the credits through the information passed by the government to the head of the village to the villagers. During that year, she bought about 400 grafted trees on this credit. In Pabin, a few villagers signed a contract in 1999 with some outsiders for 30 years, with whom they shared profits 50%.

Picture 27: Livelihood Network in Kemu



According to a farmer in BanQianDi, he learned most of the rubber planting knowledge from experiences he heard about in ZhongZhiChang. There, villagers began rubber cultivation in 1989 and the large number of rubber plantations showed that they had lots of experience in growing rubber. He also has two good friends in 2 villages (A MaXinZhai and ZhongZhiChang) who taught him how to grow rubber. He thinks that the people in these villages received governmental training on rubber cultivation whereas he gained tapping skills from a training in 2011.

A farmer from ManDian started cultivating rubber in 1996. At that time he bought the young plants from a dealer who also provided him with some information. A hired worker adopted rubber in 2007 when he took the job on a farm. His boss asked the state farm to provide him with information about tapping, fertilizer, pesticides and other management skills as well. Another villager was one such trainer in rubber cultivation. From 1991 to 2001 the government Department of Agriculture, the State Farm, and the office of the tropical crop business hired him. At that time, a state farm officer came to the village to ask whether there was someone suitable for this job and the village head and village council recommended him. He initially learned information about rubber from the sourcebooks and training provided by the state farm, and learned more when he was staff in the training program.

In Kemu village farmers started almost at the same time. Initially the village head planted the biggest plots. The rest of the villagers started small and then continued to increase their production over the next years. Rubber cultivation in Kemu village was introduced and support-

ed with subsidies by the government. The government offered the villagers an initial training and some financial support to start with their cultivation. Another farmer in Kemu also started rubber cultivation in 1996. He learned how to grow rubber from the extension officers. He said that at the time the government provided development programs for rubber that included non-interest loans and technological training. The government promoted rubber as 'an investment in the future. Initially, government programs were effective means for villagers to learn about rubber, but the adoption within villages was spontaneous after villagers saw the benefits of producing rubber and the wealth it could bring them.

Cooperatives

Different households from different villages in the region are preparing to work together in order to establish a cooperative in agriculture and forest processing products. The leader of the cooperative in BanQianDi says that rubber will also be a part of the cooperative. Planting, collecting, and buying latex from villagers will be managed within the cooperative for sale in Jinghong. The advantage of marketing through a cooperative enables villagers to sell latex directly to a factory in Jinghong, so that insights and information can be shared directly between partners. The establishment of the cooperative will also improve bargaining power. At the moment, there are 6 households involved in the cooperative, and a central building is located in a village with easy road access called GuoMenShan. The government provided the cooperative with interest-free credit for 2 years of about 50,000 RMB for the establishment. Every family involved received 50,000 RMB from the bank. The construction of the buildings is expected to be finished before May 2013 when the rainy season begins.

Livestock

In BanQianDi, some families own buffalos that can be sold to the city markets. One buffalo could be sold for about 5,000-6,000 RMB. In Kemu, villagers began raising peacocks a few years ago. Originally, they received the young birds free from the NRWNNR through a dealer in Jinghong. They sold 6 of the peacock while 5 of them died due to disease; other villages experienced this problem as well. The NRWNNR also provided information in a manual that had information about raising peacocks. This information was not enough for the villagers to successfully raise their animals. When the peacocks started to get sick the villagers went to the dealer in Jinghong to buy medicine but it did not work. Kemu villagers would consider peacock again if they were given more information on how to combat disease and other problems.

Crop Alternatives

According to a farmer from ManDian, the cultivation of dragon fruit started 2 years ago at a small scale. His source of information about dragon fruit was friends in ManDian. The introduction of the dragon fruit is not a government project but rather an initiative of the farmers. He also experimented with dendrobe, but failed due to lack of knowledge and skills. In his opinion dendrobe is not as profitable as rubber so his interest in further production is rather low.

One can see that the majority of the decisions to cultivate rubber and adopt alternatives were made through observing the wealth of neighbors who began cultivating early. The state farm and training programs are integral in the beginning stages of adoption, and maintenance of trees, from forest protection to fire prevention.

9.3 Factors influencing communication

The study setting is very unique in this respect because of the enormous ethnic diversity found in the comparably small location. Within each of the different villages there were different cultural norms. Nevertheless, there were trends in how the villagers communicated within internal and external networks. This section discusses these trends and is divided into the advantages and shortcomings of the network as perceived by the stakeholders.

Research done by TANG (2013) and LIU (2008) follows knowledge flow within the community according to basic elements of village communication: environmental conditions, tools and social networks. The next part of this subchapter is a comparison of the findings of TANG (2013) and the study team. The influences that the institution has on the way that local actors communicate will also be examined.

9.3.1 Environmental Conditions

TANG (2013) found that the proximity of neighboring villages has an effect on whether information about rubber production or markets can be shared. A Jinghong rubber farm is located 1 km from ManDian, 3 km from Pabin, and 5 km from Naban. ChaChang village is also near to Pabin, and in more recent visits, villagers were found visiting each other for dinner and celebrations. Some women in ManDian village married men from the Jinghong Farm, and as a result, farmers organized annual technology workshops and insect infestation seminars in ManDian by the No. 14 division of Jinghong Farm. Short distances between homes within villages also allow for more frequent and informal communication networks without the need to be identified as agriculturally relevant knowledge. TANG (2013) and the study group found that in many villages, the style of porches in the traditional architectural construction lends to easier communications.

Public space is another venue for informal and formal knowledge dissemination about rubber. At the village shops, community leaders' homes, and in the fields villagers share information about rubber. A result of the research was that village shops can be a place for sharing knowledge, as long as they sell food or alcohol. TANG (2013) found that during the rubber tapping, most conversations were about the daily lives of villagers including rubber, and in the off season more joke telling occurred. Shops or visiting fruit vendors could be recognized as a main meeting point for villagers. A shop owner from Naban village said that her village store is a community gathering point where she discusses rubber yield information with her girlfriends.

At the community leaders' homes, consulting on new rural policies, land contracting, rubber planting, pests, and problems were topics of discussion heard by TANG. Another field observation was that there were many visitors at the homes of community leaders. One group had the opportunity to stay in the home of the village leader in Pabin. Many visitors coming to visit many times per day could be observed. In ChaChang, most interactions took place while

drinking or gambling, and discussions did not seem to reflect topics related to rubber. According to Tang, the agricultural fields were also sites of discussion on new varieties and production systems. Her findings on the different formats and information types are shown in table 15.

Table 15: Comparison of different formats of special places

	Frequency of knowledge flow	Characteristics of knowledge flow	Process of knowledge flow for villagers
Village shop	Almost every day	Mostly about agricultural inputs	Active and positive
Village meeting room	During village meetings	Determined by the meeting content	Passive
Community leader's house	Primarily post-harvest	Problems the villagers face	Active and positive
Field	Primarily during cultivation	Centered around cultivation technology	Random

Source: Tang 2013: p.201

Village events are another site where information can be shared. There are two types of village meetings found in villages according to Tang: public meetings affecting all farmers and those only open to village representatives. Public meetings can include technology training workshops, for example the NRWNNR organized a financial management and husbandry and technology training in December 2009. Other types of meetings are where government policies can be publicly made about seed subsidies, reforestation policies, collective public affairs like road building, or land contract signings. The deputy village head of BanQianDi, said that he participates in village meetings up to ten times a year, but these meetings are mainly not about rubber, rather they concern new government regulations and policies. The village head of the same village reported that most information is shared through informal means like chats, or at festivals.

9.3.2 Communication Tools

TANG characterizes knowledge dissemination dependent on a variety of tools that lead to communication. Motorcycles, mass media, and telecommunication are forms used by villagers to share information about rubber. In the villages she visited in the NRWNNR, 80% of households have motorcycles and 30% of villagers even have more than two. These forms of transportation are very effective in receiving market information from Jinghong, especially for villages like ManDian, Naban, and Pabin, which are located half an hour away. Most men in the villages have at least one motorcycle.

Picture 28: Farmer in ChaChang



Mass media could also be a form of rubber knowledge dissemination, but in the two weeks we visited the villages, we observed that mass media is used for private use. 75% of households in ManDian and 60% in Pabin have a television, and since 2007 the number of channels amounts to 50 (TANG 2013). Most homes receive the channel CCTV-7, which has 11 programs on agricultural rural laws, new varieties, new technology, culture, agricultural business. It was found that most households prefer soap operas and children watch the most television. TANG's interviews show that the villagers in the villages she studied find the technical language of the content too complicated, and because of farmers' limited technology, poor local markets, the content is unrelated to their lives. In her experiences, she also found that Internet has not been adopted because of a lack of education on how to use computers in villages. Her talks with village heads revealed that Internet use is more popular among teenagers who travel in to the city to go to Internet cafes.

In ChaChang one could observe the community leader's children were using tablet PCs, but it was not clear if they were Internet equipped. Farmers in ChaChang village reported that they receive data messages on their cell phones with information on agriculture. Due to the widespread use of cell phones in all villages, this seems to be a cost effective and direct way of providing information to the farmers. The Bureau of Agriculture set up an information center specifically to collect useful information that can be transmitted as short message service (SMS).

At the same time, every special office and institute for agricultural development was requested to submit short messages to the information center so it could send them to farmers' mobiles via the SMS platform (TANG 2013). A rubber farmer from ChaChang reports that he

knows about the Sangnongtang information alerts, but that the technology in the messages is not suitable for the traditional methods used in his village. He also said that the alert system sends information daily to his mobile phone on crops not related to rubber cultivation, but rather about banana or watermelon production. He prefers to receive information related to rubber disease prevention and recovery. This technology is underutilized because the priorities of the audience don't match up with the official body distributing the information.

9.3.3 Social Networks

The historical dependence of villagers on one another is still present in the villages, albeit through friendships more than necessity. These close personal relations are surely due to a high level of homophily. Multiplicity also plays a large role in these communities. As certain villagers fulfill multiple roles, it is easy for people to talk one another about a wide range of topics. This tends to blur the line between formal and informal networks because there are many combinations of subject matter and settings where information can be exchanged and relationships can be built. Operationally this classification is not so important. There are many possibilities for actors to communicate with one another and seemingly low barriers to do so, which is important for a well-functioning network.

It is also evident in these communities, who the appropriate person to ask about rubber is. Opinion leaders are well known and villagers do not hesitate to identify them. In some cases it is the village head who disseminated the information about rubber cultivation (e.g. BanQianDi) and in others, villagers who had direct ties to the state farm or had spent time observing nearby rubber cultivation provided information (e.g. Huilao). Opinion leaders do not seem to be as valued in the villages that have a long experience cultivating the crop. However these villages are also more likely to have held more formal trainings (e.g. Naban, ManDian).

Formal village meetings, although not regular, are frequent in the majority of the villages. They are held normally to inform the villagers about government policy changes or to plan community events, however it results in informal conversation, questioning and sharing about various topics among villagers. In Huilao there was a formal meeting from the forest ranger regarding fire safety that drew nearly the entire village including women, men and children. Although the villagers didn't seem to pay much attention, they spoke with one another freely and a large amount celebrated after the meeting. Community meetings are important, even if they are ineffective at delivering information, because that they establish a social forum in which people can learn from various sources.

Bridging the gap between internal and external sources is the village leader, who acts as the intermediate node between the government policies and the village people. He or she is responsible for delivering the information to the people and in most cases was welcoming of visitors, whether they wanted to discuss official business or not. The availability of the village leader is surely different during the tapping season, however during field work the village leader was available to meet with people and address any concerns they had. Village leaders indicated that if they could not answer the questions posed, they would find a person who could.

Now that villagers have an increased connection to income sources that stem from outside of the boundaries of the local community, relationships are being redefined within internal

networks. Whereas villagers were formerly depending on one another for trade and everyday living, thanks to rubber income they are becoming increasingly independent. One could find this to be a positive aspect of modern day living. If a family in the community has a problem or is somehow affected, a community member could choose to help or ignore others hardship and continue on paving her way towards personal goals. However, because of the nearly homogeneous labor distribution in this region, it seems likely that a perturbation that would affect one family would certainly affect another.

Waning communication about professional life is here considered a shortcoming. Now that villagers don't have to be so preoccupied about an income source, they seem to prefer spending time together in a purely social context. This is an interesting phenomenon because it is contrary to the conditions estimated in the presence of homophily. It is possible that bonds between villagers are growing, but during the short period of time it was difficult to observe. Nevertheless, it doesn't seem like villagers perceive the need to communicate until there is a pressing problem.

The poor integration of outsiders is also a shortcoming. As villagers who are not registered as citizens in the region are not required to go to village meetings, they miss out on the opportunity to associate with the local people and to learn more about their culture. The village meeting is only one example, there were also cases in which details about renters weren't fully known. In these cases there is a heightened chance that outsiders will be excluded from relationships that bind the local community together.

In Huilao, the researchers encountered two outsiders, one who was good friends with the village leader and another who seemed isolated from the social network. This could certainly have to do with other variables, but the woman who was better integrated was only renting land on which to cultivate rubber. The other outsider was not only renting land for rubber cultivation but also had a store in the village. This difference in integration may have to do with the competition that the second villager posed to the existing villagers' livelihood.

Traditional dress, languages, preferences and priorities vary across this space, and even in the face of increased connectivity the inhabitants tend to associate with countrymen who share most baseline attributes. This is a positive aspect but could be an obstacle if the villagers are forced to cooperate between villages in the future.

9.3.4 Formal Networks

External sources were also viewed as having positive aspects. The institutional support of NRWNR was present in most villages in the form of various programs. Poverty alleviation (e.g. Huilao), alternative crop production workshops (e.g. ManDian, ZhongZhiChang) and technical trainings (all villages) to enhance knowledge about rubber were all offered. The villagers also perceived that the transaction costs in learning market information from the factory are low due to the simplicity of using a cell phone to call and the high availability of the workers. The improvement of roads has lead to improved access to more urban areas and wide variety of information sources.

In Pabin village, the role of the village forest ranger was revealed. The task of the forest ranger is to communicate the importance of forestlands. Every forest ranger has a plot of land to be responsible for. Two times per year, the forest ranger visits the state farm to learn about

protection and fire protection. The forest ranger also learned about technology of pesticides and fertilizer, and also a tapping technique using an upper and lower cut to extract more rubber. In Pabin, the forest ranger has good contacts with the village head and is a respectable member of the community that shares rubber cultivation information.

The Huilao fire safety meeting wasn't held in the local language and had to be translated in summary at the end of the meeting. Surely this leads to a loss of information.

Farmers from Naban and Pabin village also have received information on rubber cultivation from the state farm. One farmer from Naban reports that she met with an extension officer at the state farm. Her husband and brother worked at the state farm as well, and they taught her how to tap. A farmer from ZhongZhiChang said: *"My husband started growing rubber because people at the state farm started profiting from rubber."*

There are a number of public extension sector institutes in Xishuangbanna (table 16). Yunnan Tropical Plant Research Institute (YTPRI) is engaged in tropical cash-crop breeding, particularly the cultivation and dissemination of new rubber varieties. The YTPRI is located in Jinghong and has strong linkages with the local government and farmers even though it is a provincial institute because of its location.

Table 16: Official extension in Xishuangbanna

Type	Number	Institutes
Administrative agricultural organizations	4	Bureau of Agriculture (BOA), Bureau of Forest (BOF), Bureau of Science and Technology (BOST), NRWNNR Administrative Bureau
Special agricultural extension organizations	8	Animal Husbandry and Veterinary Station, Agricultural Machinery Station, Agricultural Technology Extension Station, Fishery Station, Seed Station, Soil Fertility Station, Plant Protection, Cash Crop Stations
Agricultural research organizations	4	Yunnan Agricultural University (YAU), Yunnan Academy of Agricultural Science (YAAS), Yunnan Tropical Plants Research Institute (YTPRI), Xishuangbanna Agricultural Research Institute (XARI)
Agricultural education organizations	1	Xishuangbanna Vocational and Technical Institute (XVTI)

Source: TANG 2013: p.137

Some information on cultivating rubber was obtained through formal networks in the villages. Trainings from state farms were one way that villagers learned how to cultivate rubber, but within the interviews it came out that these trainings were once and now some villagers have little or no contact with the trainers anymore. In Huilao, a villager who has 25 mu of rubber from 4 different households said that he learned rubber cultivation from the state farm. Another villager in Huilao reported that training was for free seven or eight years ago. He received sharpening tools, and a rubber knife and said that villagers only needed to cut down one tree to receive the training.

In BanQianDi, there was training in 2011. The deputy of that village said that it was the only training he received, and if there were more, he did not hear about them, as there is no fixed schedule for trainings. His brother said that this free training was not effective because many villagers' rubber trees were not mature enough to tap at this time, and most villagers were busy paving roads that were being constructed in the nearby village GuoMenShan.

The interviews also revealed that in most villages, extension officers visited once or twice every year, every two years, or on special request. In Kemu village, a farmer reported that he learned about pesticide technology from an extension officer who came to his village to teach specifically about pesticides. He said that he liked the service and would even pay for extensionists to bring experts to promote good management. Another farmer in Kemu village, LuoZhongPing, said that when fallen leaf disease occurred last year, extension workers reacted quickly and visited the community to implement a control strategy.

The last and most complicated shortcoming in communication networks is the difficult position of the NRWNNR with relation to the villages. The reserve administration supports the villagers' improved livelihoods, but it is not their policy to regulate the actions of the farmers. This has so far led to the problematic administration of projects for alternatives. However the inhabitants of most villages continue to express interest in additional revenue sources and trainings that would enable them to successfully realize a more risk diverse livelihood.

10 Conclusions

As many people are involved in the rubber cultivation and processing business it will take time until manners and thinking will become more sustainable and ecologically friendly. It seems that a gradual change has been introduced but much work still needs to be done. From this research it appears that there is an existing lack of knowledge as well as problems with the communication among the stakeholders.

On the one hand, very experienced farmers are an important target group for implementing further SURUMER projects as they see environmental changes and have a better knowledge about rubber cultivation. Thus, their cultivation techniques and skills can be further enhanced. On the other hand, there are many farmers willing to intercrop but do not have enough knowledge or have never heard of the possibilities for alternative farming practices. In most cases farmers are eager to learn and exchange their knowledge, especially when it is about to increase yields.

The main obstacle to change is still the high price for rubber coupled with too few alternative income sources. However, this situation is also likely to change and farmers need to have a clear understanding what a dependency on only one cash crop could mean when prices are dropping. While some farmers already realize the difficulties that come with monoculture, others just have started cultivating and only see the positive short-term effects on their income. Overall, it is very important that farmers have a better network among each other, with the NRWNNR as well as with outsiders to get a broader input of possibilities for their income. Additionally, they need further understanding of the ecological consequences for their environment. Education and improvement of their skills are the only possibilities so far to change the farmers' mindset towards a sustainable livelihood system. Sources of power of most influential rubber farmers can be described along eight aspects:

1) **Land ownership:** Land ownership implies the possibility to grow crops for food or for the market. Besides, it can be leased to other farmers as it is already happening in many villages in the NRWNNR. Here, rubber farmers cannot afford the time and effort to cultivate staple crops, land renting becoming an income source as well. Furthermore, land ownership provides membership to the community and the participation in decision-making of public affairs, a capacity that is restricted to outsiders.

2) **Tapping skills and management knowledge:** Farmers' expertise in tapping rubber trees is widely appreciated by other rubber farmers who constantly turn to the experts to ask for advice, thus enhancing their legitimacy.

3) **Connection to extension services:** Currently or in the past having connection to extension trainers either in a formal or informal way is definitely a strength of rubber farmer. Information and knowledge coming from extension officials help rubber farmers to be up-to-date on tree management, especially regarding pests, fertilizer and tapping methods.

4) **Financial capital:** Having monetary resources gives rubber farmers a broader capacity to make long-term decisions and take more risks than those farmers whose income is low and irregular. Training, new technologies or new cash crops are only some examples of the investments that can be afforded by those who have enough resources.

5) **Different options to sell liquid latex:** This fact increases the bargaining power of rubber farmers in the NRWNNR villages. They perceive positively the fact that they do not depend

on prices fixed by one village trader, but can negotiate with different traders and factories about the offered price.

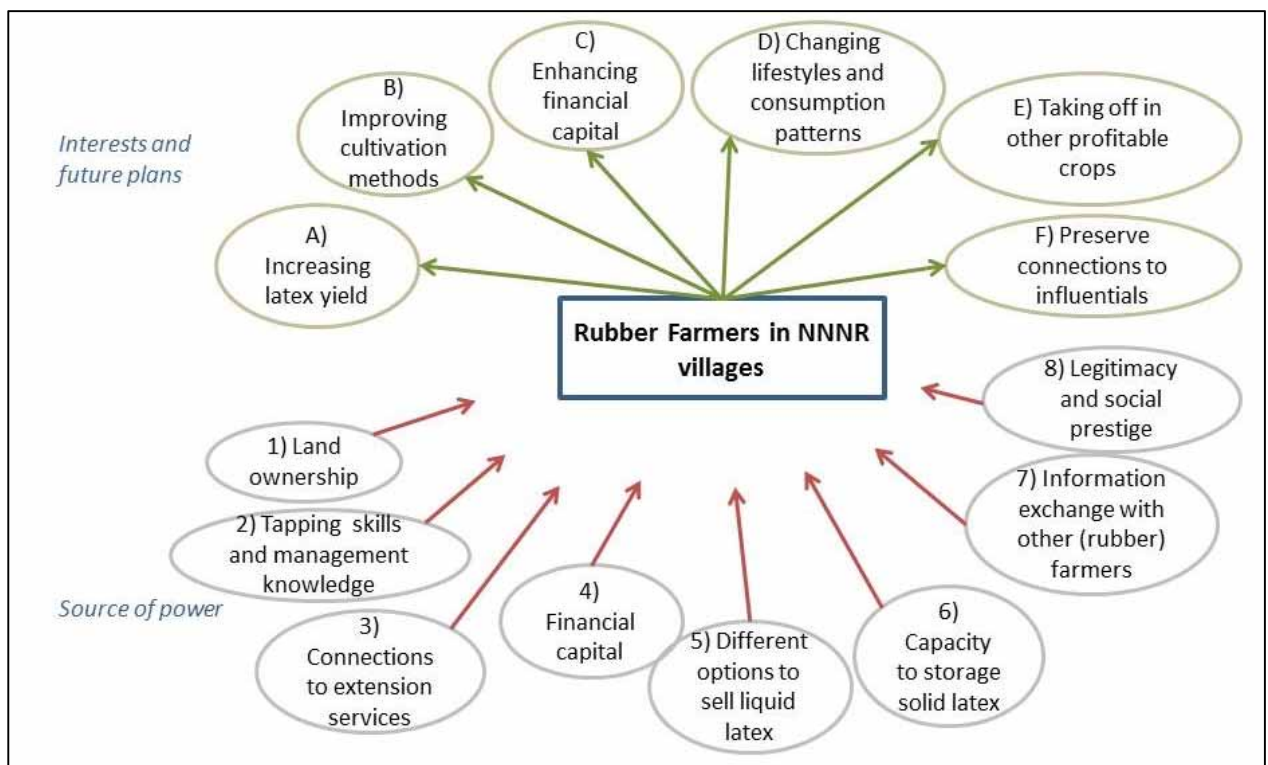
6) **Capacity to store solid latex:** In case of low latex prices, rubber farmers process and keep it until the price rises. Farmers whose financial solvency is limited cannot afford to follow this strategy and are forced to sell latex at lower prices.

7) **Information exchange with other farmers:** This fact refers to the networking of the rubber farmers; the larger it is, the better the possibilities to deal with pests, improve tapping methods, find new latex buyers or even new cash crops.

8) **Legitimacy and social prestige:** Due to the fact that rubber cultivation has substantially improved the living conditions of the villages in the NRWNNR, rubber farmers possess a high level of social prestige and legitimacy among villagers; indeed, it has been a common phenomenon that early adopters of rubber cultivation have become also village heads.

Figure 19 illustrates the twofold influences of rubber farmers as key stakeholders in rubber cultivation within the NRWNNR villages.

Figure 19: Influences of rubber farmers in NRWNNR



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Annex

Interview Guide for Rubber Farmers

Section I: Stakeholder Analysis

a. How and when did you get into rubber cultivation?

1 [Age, Sex, Education, Name of the village, membership in an ethnical group (o)] Just *observe* general characteristics before we start the interview

2 What are your duties and responsibilities in the village? (b) (leaderships, official functions in rubber cultivation)

3 In which stages of the entire process do you participate? Cultivation, trading marketing, processing (o)

b. What are the general characteristics of your farm? What are the differences with other farms in the village?

- Hired or family labor activities

- Other crops or livestock

4 Which is the size of the farm? (i) What is the total area that is used for growing rubber?

5 What did you cultivate before rubber? (i)

6 What is the average rubber yield per year ? (i) (hectare or mu)

0-1000 kg 1000-2000kg 2000-3000kg >3000kg unknown

7 Besides rubber which other crops do you cultivate? tea, banana, tobacco, rice, other.

8 Do you raise livestock?

9 What kind of technology (farming implements/ biotechnology) do you use for agriculture?

c. What are your income sources in general?

10 What are advantages compared to other crops? (i)

11 Do you get subsidies for the cultivation of rubber? (i)

12 How much of your income is made up by rubber production?(i)(More or less than 50%?)

d. Do you experience any problems in rubber cultivation? (i)

- 13 Have you recognized ecological changes in your environment over the last few years?
- 14 Have you experienced price fluctuations for rubber in the past? If so, how did you adapt?
(i)
- 15 How has your daily life changed since you and your family started cultivating rubber? (i)
- 16 What are your perceptions regarding government regulations on cultivation of rubber?
- 17 Did you experience any difficulties regarding the access to market?

e. Alternatives to Rubber

- 18 Are there production crops besides rubber in the village? (o)
- 19 Can they be profitable like rubber as a cash crop? (i)
- 20 Are there any non-agricultural incomes accessible to you? (b)
- 21 Do you have access to markets for selling non rubber goods? (b)
- 22 Can they be profitable like rubber? (i)
- 23 (If growing rubber) Would you consider or have you previously used these alternative income sources? (i)

Special Section II: Renting

f. Do you rent land?

- 24 Who is the owner of the land you are cultivating? (i) Do you have official title to your land?

g. Does anyone in your community experience difficulties with land renting?

- 25 Are there conflicts due to land use policy in NRWNNR? (i)

Land-use right holder - Why don't you cultivate rubber by yourself but lease the land?

- 26 What kind of renting payment scheme do you use? (i)

- 27 Why do use this renting payment scheme? (i)

Lessee - Why are you leasing land?

- 28 What kind of renting payment scheme do you use? (i)

Special Section III: Communication Networks

h. Where did you learn about how to grow rubber?

Relative neighbors/friends training program by state training program by rubber company, other

- 29 How do you acquire information regarding market access, rubber prices, agricultural extension?
- 30 Who do you talk to for feedback about your production?
- 31 How often do you talk to the extension officer?
- 32 How often do you have village meetings concerning rubber?
- 33 What do you like about the way you receive/share information?
- 34 (Have you ever received/shared wrong information about how to produce rubber?)
- 35 Have you changed your practices? Why? Increase yield, conservation, more land availability
- 36 Who told you about this new method? (trying to identify promoters of sustainability)

i. Who are the most important people or groups in the village regarding rubber production? Why? (both)

37 In which stages of the entire process do you participate? Cultivation, trading marketing, processing (o)

Closure Questions

- 38 What are your plans for the future of your rubber production? Growth? Higher intensity planting? Land Renting for more production? (i)
- 39 What are your wishes for improvements of rubber production? (All aspects including sustainability, social problems associated with rubber, or technical increases such as yield per mu, income generation...) (i)
- 40 Do you have knowledge in local sustainability measures? (b) If not, are you interested in gaining knowledge about sustainability measures?
- 41 Can you think of any future risks you might have to face?

Interview Guide for Hired Workers

Section I: Stakeholder Analysis

a. Can you please describe a bit about yourself regarding your role and duties in rubber cultivation?

1 [Age, Sex, Education, Name of the village, membership in an ethnical group (o)] Just *observe* general characteristics before we start the interview

b. What do you think about rubber cultivation in general? – in NRWNNR, in the village?

2 Who are the most involved people or groups in the village regarding rubber production? Why?

3 What kind of activities do you do as part of your job?

4 In which stage of rubber production do you work on? (tapping, collecting, processing, trading)?

5 For how long have you been working on rubber cultivation?

6 What is your main interest in working in rubber production? Are any (special) skills needed (if, where did you get them from?) (i)

7 Do you have other sources of income?

Section II: Cultivation methods

c. Have you ever been in contact with new cultivation methods or technologies?

8 What information about new technologies have you heard recently (incl. sustainable measures)? (i)

9 Does the farm where you work have recently adapted to new technologies of land cultivation? Which have they adapted to? (b)

10 Does this new technology have an influence on your or on your co-workers work? Please describe the changes from before (benefits, problems... concerning working hours, health, income) (i)

11 Have you been part of / were you able to influence the process of new farming methods? (i)

Section III: Conflicts

d. Has your co-worker or employer ever experienced any conflicts due to rubber production in NRWNNR?

- 12 Compared to them have you ever had (similar) problems with rubber production?
- 13 Are there conflicts due to rubber production in this village? (i)
- 14 Is your employer facing conflicts concerning land use? (i)

e. Stakeholder's Problems

15 How do you acquire information about rubber farming techniques? Would you like to acquire further information about it?

16 Who do you talk to for feedback about your job?

Do you cultivate other crops in your farm? Which ones?

and future? What are your future plans regarding employment? Do you want to take of your own rubber farm? What would be necessary to reach that goal?

Interview Guide for Village Authorities

Section I: Stakeholder Analysis

a. Can you please describe a bit about yourself regarding your role and duties as a village authority?

1. Name of the village, Age, Sex, Education, membership in an ethnical group (o) *This characteristics can be observed before we start the interview.*

2. What about rubber cultivation in the village? (i) (Heterogeneity in production?)

3. Who are the most important or influential people or groups in the village regarding rubber production? Why? (both)

b. What problems do rubber farmers experience in the village?

4. Have you recognized ecological changes in your environment over the last few years?

5. Do you recognize any effects on the community in your village related to rubber? price fluctuations? (i)

6. What are your perceptions regarding government regulations on cultivation of rubber? Do you see any impacts (positive or negative) due to such regulations? (i)

Pest and diseases?

e. Besides rubber cultivation, which other crops or activities are common in the village as means of livelihoods?

8. Can they be profitable like rubber as a cash crop? (i)
9. Are there any non-agricultural incomes accessible to the farmers? (b) Which ones?
10. How accessible is the market for selling non rubber goods? (b) *
11. Can they be profitable like rubber? (i)
12. (If growing rubber) Would you consider or have you previously used these alternative income sources? (i) *

Special Section II: Renting

- f. Do people rent land in the village? Where they are coming from?
- g. Do farmers rent land for rubber cultivation in other villages?
13. Which land use right schemes for rubber cultivation do exist in this village?
14. Which renting payment schemes exist?
15. What do you think about the renting land?
16. Do you see conflicts concerning land use? (i) Which ones?
17. Do you see conflicts due to land renting schemes?

Special Section III: Communication Networks

18. How often do you have village meetings concerning rubber? *
19. What do you like about the way you receive/share information? *

In which stages of the entire process do you participate? Cultivation, trading marketing, processing (o)

Closure Questions

22. How do you think the future of rubber production in the village is? Growth? Higher intensity planting? Land Renting for more production? (i)
23. Do you think the farmers may have interests or knowledge in local sustainability measures?
24. Is there any official plans regarding rubber cultivation?

Interview Guide for NRWNNR Authorities

Section I: Stakeholder Analysis

a. Can you please describe a bit about yourself regarding your role and duties in rubber cultivation?

- 1 Age, Sex, Education, Name of Village, membership in an ethnical group (b)
- 2 For how long have he/she been working on rubber cultivation? (i)
- 3 Function, position and tasks in NRWNNR (For which area are you responsible? What are the main tasks of your job?)
- 4 Who are the most influential villages or farmers regarding rubber production? Why? (both)
- 5 Perception of influential villages in rubber production and in sustainable cultivation.

b. How influential is the NRWNNR on rubber production?

- 6 Which restrictions due to rubber cultivation exist within the protection zones in NRWNNR? (o)
- 7 How do conservation policies affect rubber production in the NRWNNR? (b)
- 8 How are those regulations planned, implemented, monitored and evaluated in the NRWNNR? (b) answer can also be used for the network section
- 9 To what extent can the NRWNNR regulations influence the rubber cultivation process? (i)
- 10 What mechanism/ methods do you apply to influence the process? (i)

c. Which conflicts/interests concerning rubber cultivation exist?

- 11 Are there conflicts due to land use in NRWNNR? (i)
- 12 What are the main problems the NRWNNR is experiencing in rubber cultivation? (i)
- 13 Have you recognized ecological changes in the reserve's environment over the last few years? Does it differ depending on what crops the region cultivates?
- 14 Do you recognize social changes within the communities since the beginning of rubber cultivation? Differ based on region?
- 15 What are the main differences between 'rubber- and non rubber-communities' regarding their lifestyles (socially, economically)?

Section II: Renting

d. Who owns the land within the NRWNNR?

16 Which land use right schemes for rubber cultivation do exist in the villages?

17 owner rights change after the NRWNNR was established? (lit?)

18 Are there new conflicts in the NRWNNR due to changed owner rights?

Section III: Communication Networks

e. How do NRWNNR authorities use information for rubber production?

19 Who informs you about new environmental policies? (lit?)

20 Who informs you about new technologies/application methods? (lit?)

a Maybe just: Where do you get most of the information applicable to rubber farming in the NRWNNR?

21 How do you get information about the current situation in rubber farming?

a Mass media, government communication, research institutes, etc.

22 How do you communicate with different landowners?

23 Which villages are influential in rubber farming? How are they influential?

a Have they adopted to new technologies?

f. What kind of extension service does the NRWNNR provide for rubber cultivation?

24 What kind of extension services for sustainable cultivation exists?

25 Are farmers interested in utilizing these services?

a Difference of adapting / interest depending on farm size?

26 Are there measures being taken to promote extension services?

27 Do you have any influence on extension services offered?

Closure Questions

28 What are your wishes for improvements of rubber production? (All aspects including sustainability, social problems associated with rubber, or technical increases such as yield per mu, income generation...) (i)

29 Do you see sustainable and conservation oriented rubber production as feasible? (i)

30 Are you on the way to achieving those goals in the NRWNNR? (i)

31 What are the main obstacles to your conservation and sustainability with regards to rubber production? (i)

Code List

How to use the Catalogue of codes:

- a. Create a table (1 Column for the codes, 1 Column for the pieces of information from the transcripts)
- b. Create a copy of your transcript which you will use to cut out the pieces of information
- c. Go through this document (b) and according to the codes, select the sentences and paste them into the table (a)
- d. Always copy whole sentences. In case they fit for more than code, copy the sentences again.
- e. Make sure you add the name of the village and interviewee to the selected information.
- f. In the end your transcripts should be empty. If there is information that can't be dedicated to one of the existing codes create a new one, see 6.NN (Only if really necessary).
- g. Otherwise DON'T change and mess the codes and make sure you inform EVERYONE if you create a new code.
- h. Change the name of the document to:
 - YYYY_MM_DD_villagename_yourname_interviewee.doc
- i. Add the document to the Dropbox: 'Findings from Field Research' – 'Codes' (Folder)

Codes:

1. Villages description
 - 1.1. Traditional customs
 - 1.2. Livelihood (Income, health, education, employment etc.)
 - 1.3. infrastructure
2. Stakeholders role in rubber cultivation
3. (Changes in) Land use / rubber cultivation
 - 3.1. Changes in Land use
 - 3.2. Present land use: Vegetation & Crops
 - 3.3. Present land use: Size of cultivated land
 - 3.4. History of rubber cultivation
 - 3.5. Ecologic Impact of rubber cultivation
 - 3.6. Economic Impact of rubber cultivation
 - 3.7. Social Impact of rubber cultivation
 - 3.8. Institutions influencing land use
 - 3.8.1. Ownership / property rights
 - 3.8.2. Lease & land renting
 - 3.8.3. Conversion of land
 - 3.8.4. Impact of lease/renting
4. Stakeholders' problems and ambitions

- 4.1. Ecological problems
- 4.2. Economic problems
- 4.3. Changes in social life
 - 4.3.1. Ambitions (formerly called 'interests')
 - 4.3.2. Rubber
 - 4.3.3. Alternatives
 - 4.3.4. Livelihood & General
- 5. Adoption and Communication
 - 5.1. Adoption of Rubber (Who, When, Why, How, Where)
 - 5.2. Adoption of alternatives (Which, Who, When....)
 - 5.3. Communication Networks internal
 - 5.4. Communication Networks external

The Research Team



About the book

This study was carried out in collaboration of Humboldt-Universität zu Berlin, the China Agriculture University, Beijing, and the Naban River Watershed National Nature Reserve Bureau (NRWNNR) in Xishuanbanna Dai Autonomous Prefecture, Yunnan Province, PR China. The research group is part of the SURUMER Project, which is concerned with sustainable rubber cultivation in the Mekong Region.

The report provides the results of a Stakeholder Analysis in the Naban River Watershed National Nature Reserve; case studies in eight villages on current land use, stakeholders' problems and interests with regard to rubber cultivation, alternatives to rubber cultivation as well as knowledge dissemination and communication networks.